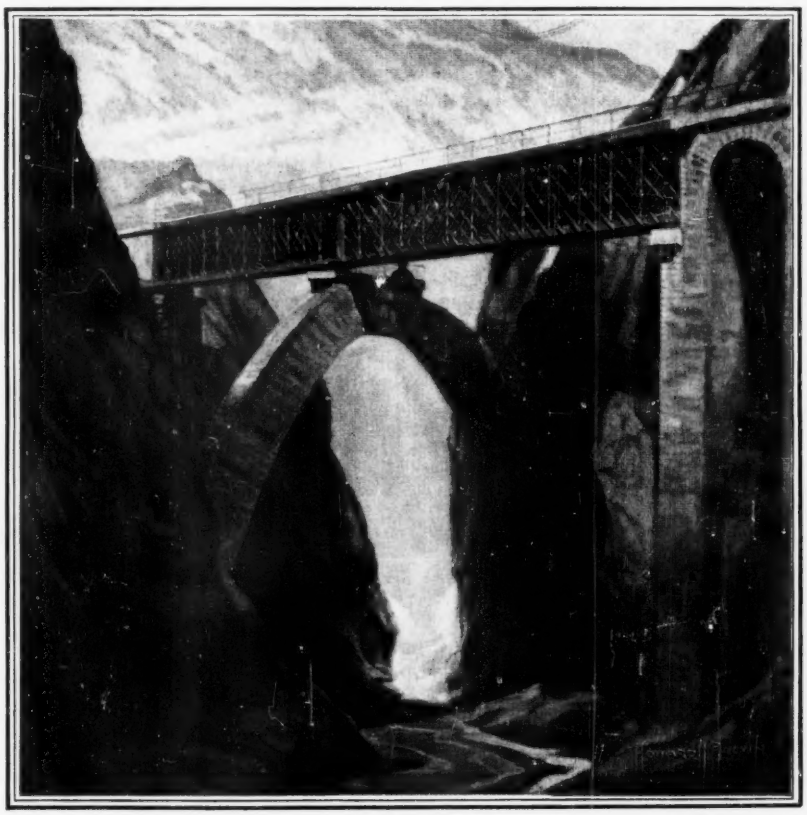
SCIENTIFIC AMERICAN

February 1929 35¢ a Copy



THE HUNT FOR THE HUB OF THE UNIVERSE

CHEMICALS AWAKEN SLEEPING PLANTS

INVESTING IN AVIATION

GOUGING OUT THE RIVER BEDS WITH THE HELP OF SKF BEARINGS

MEN who build the great mechanical monsters that perform the Herculean tasks of the world don't think of construction units in terms of PURCHASE PRICE. They think of them in terms of what they will do—of the FINAL cost reckoning at the finish of the job.

It is significant that the U. S. Engineer Department as well as practically all the biggest engineering companies in the country has selected SKF Bearings for heavy marine equipment such as dredge pumps, cutter head drives and tow boats.

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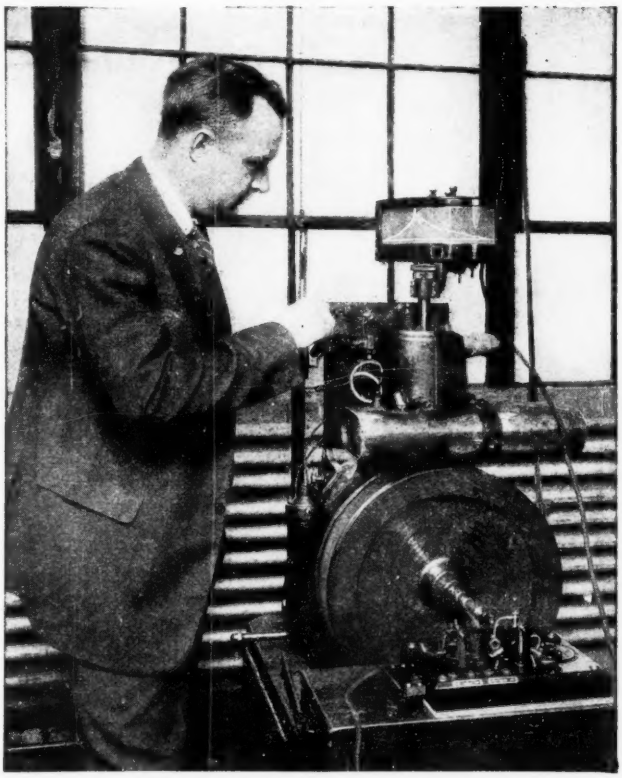
"THE HIGHEST PRICED BEARING IN THE WORLD"

On the trail of the "KNOCK"

(The indicator hound)



This is Thomas Midgley, Jr , the inventor of Ethyl Gasoline, and the Midgley Optical Indicator, the machine which played such an important part in the development of Ethyl. The Midgley Optical Indicator, mounted on an engine, took a picture of what occurred inside the combustion chamber and enabled Mr. Midgley and his associates to establish the cause of the "knock."

WHEN you hunt a wild animal, you usually take along a dog that can follow the animal's trail. So when the scientists in General Motors' Research Laboratories started to trail the elusive and annoying "knock" in the gasoline engine, they had to develop a sort of scientific dog that could show them where the knock was and what sort of thing it was.

It is rather disrespectful to call the Midgley Indicator a "scientific dog." It is a most ingenious mechanism that records the pressures in the cylinder of a gasoline engine while it is running. By studying these pressures the scientists found out what was happening when the engine knocked. In fact, they found that it was the *fuel* that knocked, not the engine.

It was all part of the long trail of investigation that led to the discovery of tetraethyl lead as an anti-knock. To-day leading oil companies add Ethyl fluid (containing tetraethyl lead) to gasoline. As Ethyl Gasoline, this better fuel is now available all over the country.

But Ethyl Gasoline has done much more than eliminate the "knock" in gasoline engines. It has made possible the construction of high compression engines. With these it has introduced a new era of motoring comfort and efficiency.

The millions of cars of ordinary compression run better on Ethyl too—for carbon formation automatically raises their compression. Have *you* tried Ethyl?

ETHYL GASOLINE CORPORATION
25 Broadway, New York 56 Church St., Toronto, Canada
36, Queen Anne's Gate, London, England

Knocks out that "knock"

© E. G. C. 1929

ETHYL GASOLINE

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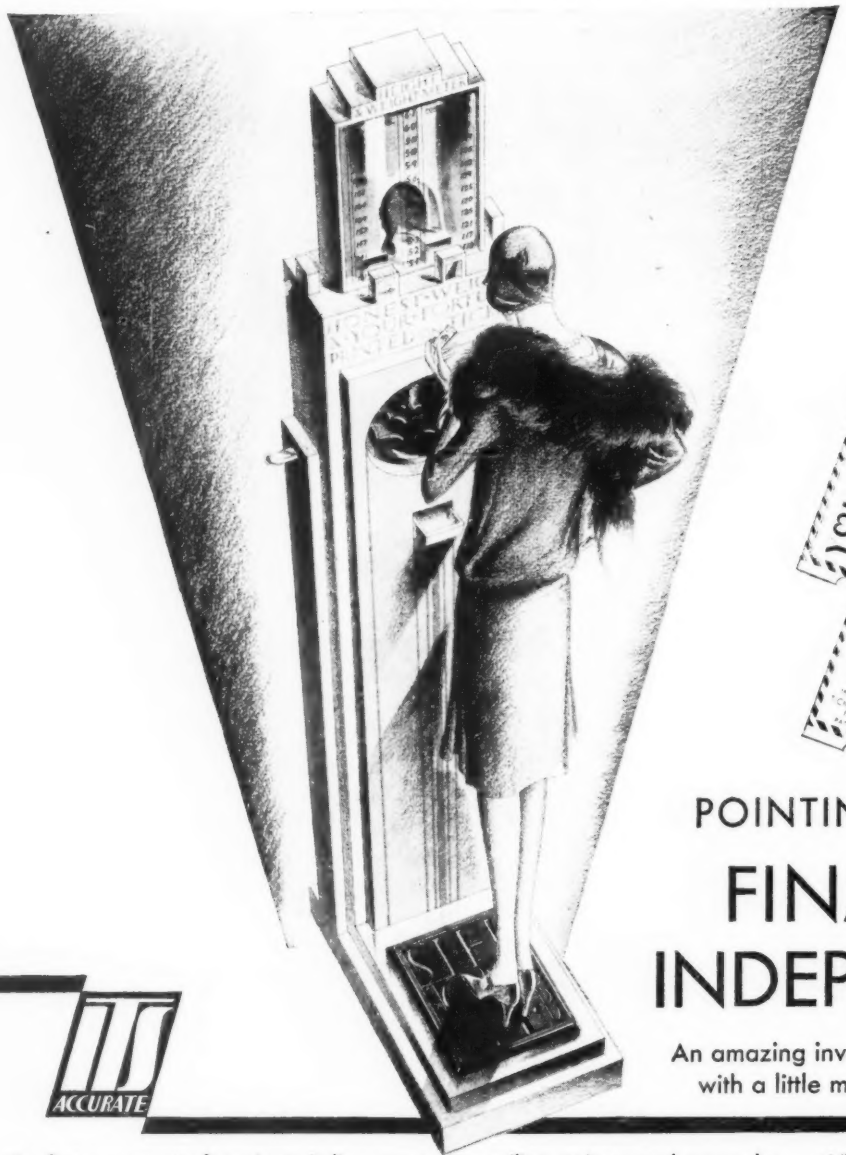

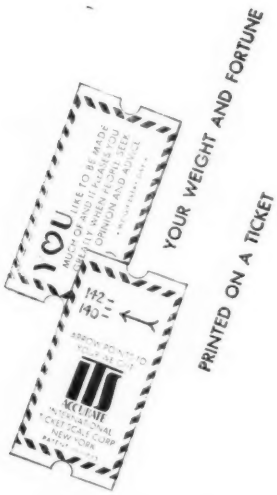

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February 1929 — *Edited by ORSON D. MUNN* — *Eighty-fifth Year*

IN THIS ISSUE

CONTENTS—FEBRUARY, 1929

The Clean and Honest Eskimos—By Donald A. Cadzow 105
"Inuits" of the Arctic Circle Are Honest, Truthful, and Friendly

Our Point of View—Editorials 108
Rubber; Oil in Sewers; Engineering Education; Sea Safety; Water-power; Speed; Dispelling the Gloom

What Things Are Made Of—I—By Arthur H. Compton, Ph.D. ... 110
New Physical Concept of the Earth—Protons, Electrons, "Photons"

From the Scrap-book of Science 114
Camera Shots of Scientific Subjects

Chemical Alarm Clocks Rouse Sleepy Plants—By A. E. Buchanan, Jr. 116
Chemical Accelerators Awaken Plants to Earlier Acitivity

A Use for Everything—By Milton Wright 118
A Variety of Waste Products Now Salvaged and Sold

We Offer a Medal for Safety at Sea 121
New Equipment Is Needed to Prevent Disasters at Sea

A Beacon for Birdmen—By L. B. Ellis 122
Giant Bell Tower in Florida Bird Sanctuary To Be a Guide to Fliers

The Month In Medical Science—By Morris Fishbein, M.D. 124
Child Deafness; Noise; Inherited Finger Nail Trouble; Kaiser's Arm; U-V Rays Change Blood; Seeing the Spine; Airplanes—Mosquitoes

With "Fuzzies" After Ibex—By H. E. Anthony 126
A Scientist Turns Big-game Hunter in the Sudan

Picturing Skill in Golf—By Charles B. Brewer 130
New System of Charts Allows Intelligent Following of Matches

The Hunt for the Hub of the Universe—By Henry Norris Russell, Ph.D. 132
New Research Reveals Central Nucleus of the Galaxy

In the Birthplace of Pure Iron 134
Removing Impurities from Smelted Iron

The "Sinking" Tower of Pisa—By Albert G. Ingalls 137
It Is Planned to Cement the Tower's Sub-foundation

A Pre-cast Seven Mile Bridge—By Charles W. Geiger 138
Bridge Across San Francisco Bay Made Up of Pre-cast Units

Type-setting By Telegraph 141
New Machine Sets Type Many Miles Away

A British Destroyer Leader—We Have None 142
Great Britian and Japan Outdistance Us In Building These Ships

The Romans In East Anglia—By J. Reid Moir 144
New Excavations Reveal Fresh Evidence of the Romans in Britain

Sing Sing, Past and Present 147
Segregating and Educating Criminals in a Famous Prison

Investing In Aviation—By Professor Alexander Klemin 148
A Thorough Survey of the Financial Possibilities of Aviation

World's Largest Hall Seats 40,000 People 154
Massive Structure in Atlantic City Ready for Huge Conventions

Salt From the Sea 157
Thousands of Tons Reclaimed From Sea Water Yearly

Tools for the Shop and Home .. 158
Work Bench—Tool Chest 158
Nail-Starting Hammer 158
Press Feeder Vacuum Holder 158
One-piece Hammer 158
New Saw Blade 158
Height Gage 158
Rigid Vise Support 159
Collapsible Miter Box 159
Drill Chuck 159
Hacksaw 159
Vise Pliers 159
Hook Scraper 159
Combination Bevel 159

Household Inventions 160
Paring Knife 160
Folding Chair 160
Flower Holder 160
Screen Ventilator 160
Tooth-brush Holders 160
Hand Massage Pad 160
Kerosene-operated Refrigerator ... 161
Sewing Basket 161
Wheel Chair 161
Writing Desk—Piano 161

Scientific American Digest 162
Lafayette Dam Failure 162
The 1928 West Indies Storm 162
Radio Soprano Correction 163
Best Collection of Rare Gases 163
Rubberized Violins Rival Old Masters 164
Removing a Wreck from New York Harbor 164
Measuring Moisture in Lumber ... 164
Mine Rescue Sledge Stretcher 165
Sextant Lighted by Flashlight Cells 165
Widows Settled Store Clerks 180
Low Temperature Coffee Percolator 180

Industries From Atoms 166
Self Rescuer For Use in Mines 166
A Trick In Dynamite Manufacture 166
Cryogenic Laboratory (Illus.) 166
Humidity Control, Explosions 167
Dangers In Dust 167
Benzol From Methane 176
Chromium Plating Hazards 176
Asphalt From Petroleum 176

Learning to Use Our Wings 168
The Chicago Air Show 168
ILA 170
Gas Holder "Lighthouse" 182
Book Review 183

Current Bulletin Briefs 172

The Back Yard Astronomer 174

The Heavens in February 178

Commercial Property News 187
Are We Slowing Down? 187
Employers' Shop Rights 187
Trademarks In Greece 187
Chinese Irish Lace 188
Idem Sonans 188
European Cartels 188
Rights Must Be Asserted 189
41,000,000 Pounds of Snuff 189

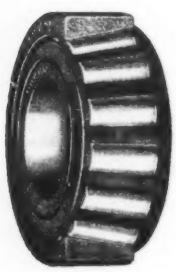
Patents Recently Issued 188

COVER

The unique bridge which our artist, Howard V. Brown, has pictured this month, crosses a gorge of the Bevera not far from Nice, France. A vertical support in the center of the span would have choked the gorge, so this transverse masonry arch, at right angles to the steel span, was resorted to. The span is approximately 300 feet long.

WHO and WHERE

Of the 40 Manufacturers of Passenger Cars in This Country, 35 Use Timken Bearings at the Points Indicated by Crosses



Make	Model	Front Wheels	Rear Wheels	Pinion	Steering	Differential
Auburn	All	x	x	x		x
Cadillac	All	x	x		x	x
Chandler	65 & Royal 75	x	x	x		x
	New Big 6 & Royal 85	x		x		x
Chrysler	De Soto	x	x	x		x
	Plymouth	x	x	x		x
	65 & 75	x	x	x		x
	80	x				x
Cunningham	All	x	x	x		x
Dodge	All	x	x			x
Durant	M4 & D60	x	x	x		
	D70 & D80	x	x	x		x
Elcar	6-70	x				x
	8-78, 8-82	x	x			x
	8-91, 8-92	x	x			x
Falcon	All	x	x	x	x	x
Ford	All	x		x	x	x
Franklin	All	x	x	x	x	x
Gardner	All	x	x	x		x
Graham-Paige	610	x	x	x		x
	614	x	x			x
	619, 629, 835	x	x		x	x
Hudson & Essex	All	x	x	x		x
Hupmobile	Century 6	x	x	x	x	x
	Century 8	x	x	x	x	x
Jordan	All	x	x	x	x	x
Kissel	All	x	x	x		x
Kleiber		x	x	x		x
LaSalle	All					x
Lincoln	All	x	x	x	x	x
Locomobile	All	x	x			x
Marmon	68	x				x
	78		x			x
McFarlan	All	x	x	x		x
Moon	All	x	x	x		x
Nash	Std 6	x	x	x		x
———	All	x				x
Peerless	8-69	x	x			x
	6-91, 6-60 and 6-80	x	x	x		x
Pierce-Arrow	81	x	x	x		x
	36	x	x			
Reo	Flying Cloud	x	x		x	x
	Wolverine	x	x			x
Roamer		x				
Stearns-Knight	All	x	x	x	x	x
Studebaker and Erskine	All	x	x	x	x	x
Stutz	All	x	x	x		x
Velie	All	x	x	x	x	x
Willys-Overland	Whippet 4	x	x	x	x	x
	Whippet 6	x	x	x	x	x
	56	x	x	x	x	x
	66-A	x			x	x
	70-A	x		x	x	x

TIMKEN Tapered ROLLER BEARINGS

TIMKEN Tapered Roller BEARINGS

Looking Ahead *With the* Editor

MARCH—SPECIAL AVIATION ISSUE

Planes For Private Flying

ALTHOUGH the time is far in the future when the skies will be filled with "flivvers of the air," airplanes are being bought in ever-increasing numbers for private use. The man who contemplates buying a plane for such use, however, encounters so many questions concerning the kind to buy, the factors of safety, operation, et cetera, that it behooves him to look well before he buys. An article in our March issue will explain these facts to the prospective private flier.

Faster Air Mail

REFERENCE to the newly-invented package pick-up apparatus has been made in our pages and in other magazines but its potentialities have never been fully outlined. An article to be published in March describes it in complete detail for the first time and shows how it may expedite air mail and freight pick-up.

An Amateur in the Air

INSPIRED by an article on gliders which we published some time ago, a reader determined to make a life-long dream come true by constructing a glider. For a man unversed in the principles of aircraft design, the job was a big one, but he finally succeeded and experienced the great joy of flying his home-made craft. In an article coming in March, he tells all about this job.

The World's Largest

WHEN the *Graf Zeppelin* was completed some months ago, Commander Rosendahl, U. S. N., went to Germany to get first hand information concerning its construction and operation. He was a passenger when this air giant made its test flights and again when it flew to America. As commander of the *Los Angeles*, he knew how to study this newest and greatest ship of the air, and will give his observations in an article to appear soon. He will reveal facts about the *Graf Zeppelin* hitherto unknown to the public.

Growing! Growing! Growing!

AVIATION is growing up. It has outgrown the pilot-designer stage; the pilot is left to his job of flying and experts are doing the research, designing planes, and building the business. An article in our March issue tells the story of these men—engineers, technicians, business men, et cetera—who, practically unknown, have contributed much to aviation's progress.

¶ *Even with this vast array of aviation material, other subjects will not be neglected, and our readers will be presented with articles on diversified science that will be just as noteworthy as those on aviation.*

Among Our Contributors

Donald A. Cadzow

As a trader in Alaska at the age of 17, Mr. Cadzow learned enough about Eskimos and unknown Indians to cause him to take up anthropology. He has led expeditions for the Heye Foundation and the Museum of the American Indian, to Alaska, Hudson's Bay, Canada, and in the United States. His work is reflected by complete anthropological collections at the above-mentioned museum.

A. E. Buchanan, Jr.

Mr. Buchanan's article on page 116 on the process of rousing plants chemically, presents some interesting possibilities. It may be that, some day, we may make our house plants thrive and bloom in winter with chemicals from the corner drug store.

H. E. Anthony

Since 1911, Mr. Anthony has been engaged in the study of mammals, has collected them and studied their habits in North, Central, and South America. Often his trips bring him in contact with savage and practically unknown tribes. In the Sudan, he found not only a magnificent mammal fauna but also fine races of primitive peoples. He is curator of the Department of Mammals of the American Museum of Natural History.

J. Reid Moir

When one of our editors recently visited Mr. Moir at his home in England, he found him immersed in the atmosphere of his work he so vividly describes in his articles on archeology. Due to Mr. Moir's efforts, the prehistory of a large quarter of England, from man before the ice ages to the Romans in ancient Britain, is being revealed.

Arthur H. Compton

A mere handful of younger physicists are playing ducks and drakes with the old, classic concepts of the foundations of physics. Dr. Compton is one of them. The Nobel Physics Prize recently awarded him was no accident; it came because he demonstrated some of the things he fails to take credit for in his article on page 110.

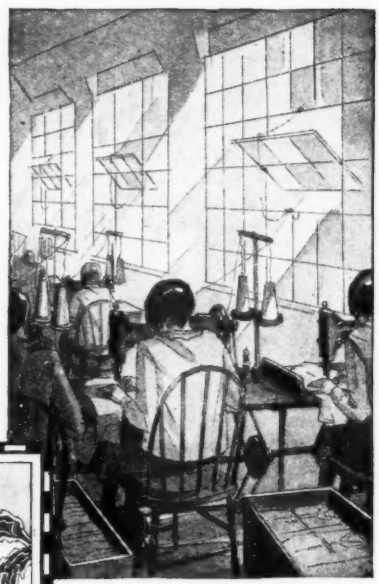
FIRST

in the Production of

WEARING APPAREL

West of Chicago

The acknowledged position of Los Angeles as one of the fashion centers of the style world is borne out by the fact that there are over 30,000 power sewing machines in the Los Angeles District



To manufacturers seeking expansion in the Pacific Area, the Bureau of Power and Light offers invaluable cooperation in the solution of this problem. A comprehensive survey will be made, without charge, for any specific industry

THE style world spends many millions of dollars annually for Los Angeles-created-and-made wearing apparel. Within a few years, Industrial Los Angeles has forged ahead of all western cities in this basic industry.

In the successful manufacture of clothing the essential factors of high output, low production costs and profitable distribution are here available. As the wearing apparel industry of a city grows, so does its general industry prosper.

The western industrial leadership of Los Angeles is firmly based on: freedom from labor troubles... intelligent skilled operatives... efficient working climate... center of Pacific Coast population... low building costs... excellent transportation by truck, rail, and water... abundant, cheap water and power.

Industrial Los Angeles is completely electrified. Cheap and adequate Municipal power has made low unit costs a large element in local manufacturing, and has given Los Angeles the industrial leadership of the West.

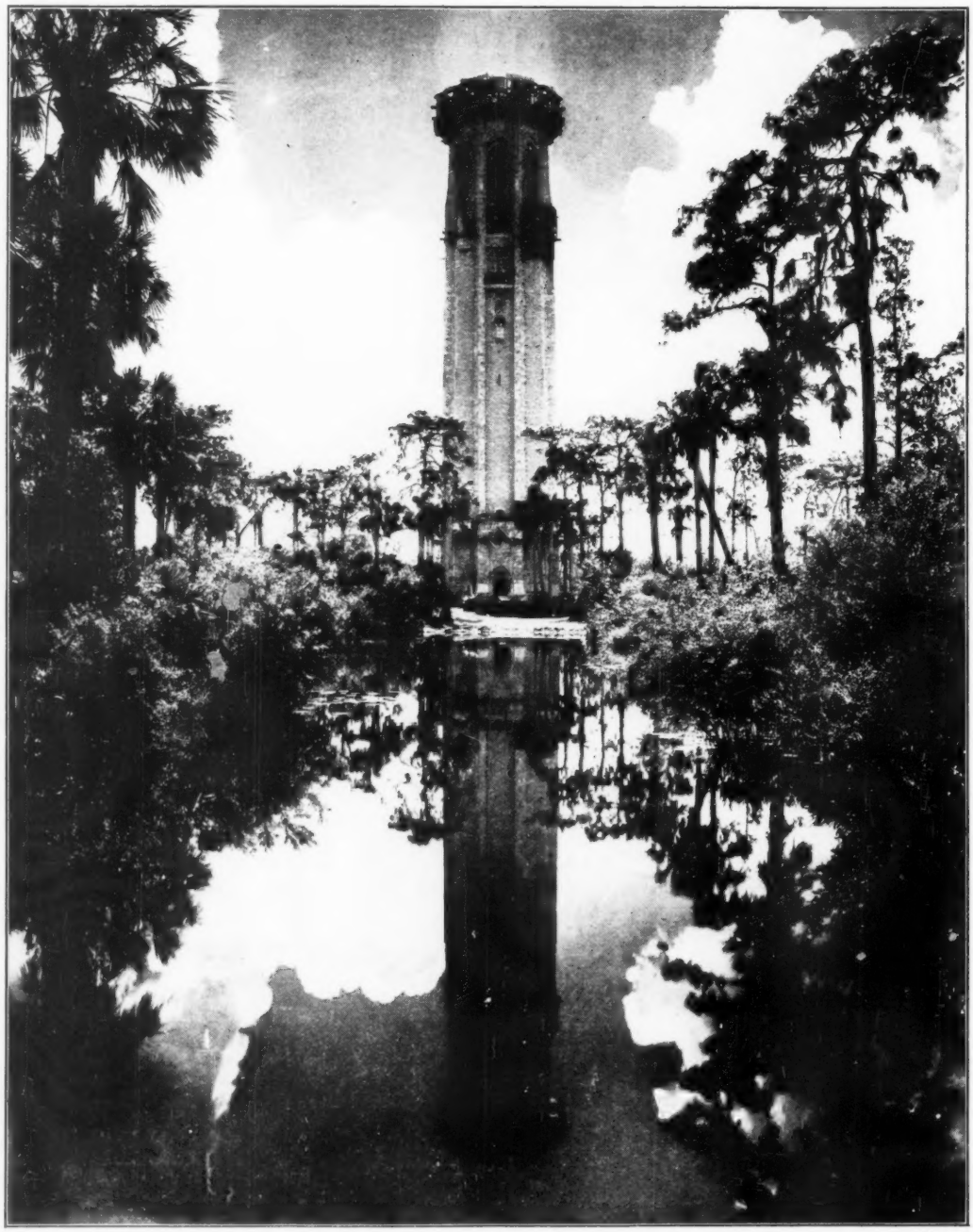
BUREAU OF POWER AND LIGHT

CITY OF LOS ANGELES

INDUSTRIAL LOS ANGELES

Dr. Annie J. Cannon

DR. ANNIE J. CANNON of the Harvard Observatory is the curator of the largest and most valuable collection of astronomical photographs in the world. She is, in addition, recognized as the most eminent woman astronomer. Her contributions to knowledge during the last 30 years have related to the variations of stars, their distribution in space, and above all to their classification. Her work in the classification of a quarter of a million stars, published in the famous nine-volume Henry Draper Catalogue of the Harvard Observatory, has brought her international fame and high honor in many countries, including honorary degrees from Oxford, Gröningen, Wellesley, and the university of her native state, Delaware. As curator of astronomical photographs at Harvard she has supervision of a collection of more than 300,000 glass negatives, made during the past 40 years with many telescopes at Harvard observing stations in the northern and southern hemispheres. The collection is in continuous use in the Observatory's studies of the classes, variation, and motions of stars, the distance of clusters and nebulae, the size of our Galaxy, and the distribution of those faint external Galaxies that lie out toward the remote boundaries of the universe



Florida's Latest Aerial Beacon

IN the beautiful wild life sanctuary at Mountain Lake, Florida, is situated a unique combination of Old World beauty and modern utility. This is the "Singing Tower," built and given to the state by E. W. Bok. Located on Iron Mountain, the highest point of land in Florida, the tower rises 205 feet above its base. Placed within the tower at various heights are the bells of a huge carillon—61 of them. On the top of the tower is to be placed a powerful beacon, as such a high point in an otherwise low, flat territory would, if unlighted, be a menace to increasing aerial traffic. Beacons of this sort, properly located and tended, are an increasing necessity, and this one reflects the foresight of its donor. (See also page 122.)

ABOUT TO EXECUTE A "KAIAK SPIN"

In these light, bouyant, skin-covered boats, Eskimo boys and men take great delight in turning over and over in the water. A water-proof jacket lashed to the boat gunwale and the wrists prevents water entering the covered craft

The Clean and Honest Eskimos

In Honesty, Truthfulness and Friendliness the "Inuits" of the Arctic Circle Are at Least the Equal of the Civilized White Man

By DONALD A. CADZOW

MY first meeting with the Eskimo was in the fall of 1911, at Rampart House in the northern part of Alaska. My idea of an Eskimo up to that time probably coincided with the average person's conception of these interesting Arctic dwellers. I had not heard that the Eskimos came to Rampart for trade, and when several families of them came in over the mountains from the north, I mistook them for unusually clean and cheerful Indians. They were not at all like my imaginary Eskimo, who was short, fat, and greasy; constantly chewing on a piece of raw blubber. They were big, clean, and very friendly.

TOOL-A-WAK, or "Crooked Arm," was their leader, chosen because of his slight knowledge of the English language. In a few days Tool-a-wak and I became fast friends, and during the five years that I lived in the western Arctic, he and his wife considered it their duty, as my friends, to see that I was properly supplied with skin clothing every fall.

In my wanderings above the Circle, Tool-a-wak's igloo, wherever it might be, was my home. He and another Eskimo, named Koo-ru-guk, were my companions on many weary miles of trail over the frozen tundra.

Since I left the friendly shelter of Tool-a-wak's little snow house in northern Alaska, I have visited many of his people in Arctic America, as far east as Baffin Land, for the purpose of studying their life and customs. And, as a race, I have found them to be a most interesting group of people, about whom very few authentic facts are really known by the general public.

Just how many Eskimos we have on the North American continent is not known. We do know, however, that there are about 25,000 of them scattered along the 5000 miles of Arctic coastline. As a rule, most people consider them as sort of an Arctic Indian, whereas the name Indian, although it is the common designation for all the natives of America, is not intended to include the Eskimo. The two races have nothing in common. Up to the time white men ventured into the far North to trade for fur, they were at war. To this day they do not trust one another in any of the regions I have visited.

SLEEP OF THE JUST

Eskimo babies, naked, are carried under the mothers' hood next to her skin. Here baby sleeps as mother works

THEY do not like to be called Eskimos, for in most places they do not know what it means. They prefer to be known as Inuits, which in their language means "people."

The name Eskimo (in the form Excominquois) seems to have been first given to them by a man named Baird in 1611. It comes from the language of a tribe of Indians known as Abnaki, who lived in the region now occupied by the state of Maine. It is a corruption of the word Esquimantiac, meaning "eaters of raw flesh." The name really is quite appropriate even today, as most of the Eskimos prefer certain foods raw and frozen rather than cooked.

They vary in size in different localities. In Alaska, as a gen-

eral rule, however, they are fairly large in stature, men and women averaging about five feet, six inches in height. In Greenland and on the coast of Labrador I have found them to be much smaller, but otherwise the same people, speaking the same language, with only a slight difference in dialect. The skin of the Eskimo is light colored with a ruddy tint; their hands and feet are small and well formed. Their eyes have a Mongoloid character which might indicate Asiatic origin. But to day, no scientific evidence has been brought forward to prove that they came from Asia.

Explorers have used the Eskimo's mode of existence to carry on their work, and today many objects invented by them cannot be improved upon by white men. One of these inventions is the stone lamp, used in the igloos and tupiks for heating and lighting. They have been possessed by the Eskimo from time immemorial, and they are the only aborigines of this hemisphere who had such utensils. The Etruscans on the Mediterranean Sea are the only other primitive people who are credited with the invention, and their country is a far cry from the Arctic. The Eskimos have always been, and still are, utterly dependent upon their lamps for existence, for with no fat or oil in the snow houses in winter to feed the lamps, the Eskimo will freeze to death. Moss mixed with oil rendered from animal fat is burned in the lamps.

CHEWING SEALSKIN

The process of chewing softens the stiff skin, but often results in damage to the teeth, as described by the author

IN southern Alaska the lamps have a narrow wick edge and are shaped like a flat-iron. In other sections they are made of clay, feathers, and seal blood mixed together, shaped like a saucer, and hardened in the sun. In the northern part of Alaska and all along the Arctic coast to Greenland they are made of soapstone in various forms. The length of the wick edge of these lamps has been observed to vary with latitude, that is, the higher the latitude, the longer the night, hence the greater need for light, which is met by lengthening the margin of the lamp on which the moss wick is placed.

The snow houses in which the Eskimos live in winter are marvels of engineering, and in building them of blocks of snow, the principle of arch construction is used. The only other use in the world of this arch by primitive people was by the Etruscans. In early times, as proved by recent archeological research, the Eskimos lived in winter in houses dug out of the ground. The sides of these houses were built up with walls of sod and stone and the roof was covered with whale ribs upon which skins probably were placed.

Then came the invention, long before the advent of white men, of the snow house. Some Eskimo devised the arch with his snow blocks which he built up in spiral courses. To this day the snow houses are the only comfortable type of house in which to live during an Arctic winter. They are constructed in various sizes, from the little igloo of the hunter, in which he spends one or two nights, up to the great community house, sometimes twelve or fourteen feet high. The latter house usually is built on a smooth spot on the ice and most of the tribal dances and ceremonies are held in it. The younger men use it as sort of a gymnasium where they can wrestle and show their skill and strength in various ways. The medicine-men often carry on their mysterious rites in the ceremonial houses, and meat is cut up and divided here. In Eskimo land if only one hunter is successful, he always divides his kill with the rest of the band.

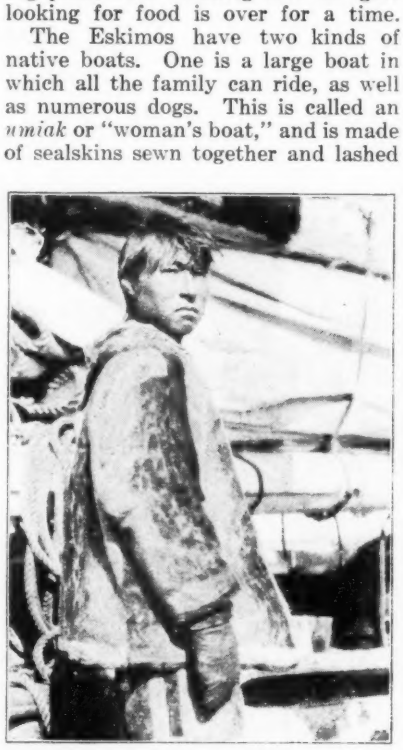
IN extremely cold days in winter, say 65 degrees or 70 degrees below zero, the children come into the big snow houses to play their games. One of these games, called seal hunting, is a great favorite among the boys. Two boys will take a sealskin with several round holes cut in it, and each will hold one end. Another boy will take a piece of skin cut out to represent a seal, and this he moves around underneath the holes of the big skin. Standing nearby is the boy who is supposed to be the hunter. He holds a small spear in his hand, and as the imitation seal passes under the holes he tries to spear it. A close record is kept of the number of times a boy hits the seal, as this is supposed to indicate whether or not he will be a successful hunter when he is a man.

Another game is played by both men and boys with a little ivory polar bear which has a number of holes drilled into it. This is attached to a piece of string with a sharp pointed bone tied to the end. The bear is tossed into the air, and the game is to catch it on the bone. If the bear is missed it strikes the player on the knuckles; this is supposed to represent a bite from the bear.

The little girls come to the big snow houses to play with their dolls, and their mothers to gossip, sew, and soften their husbands' boots and other clothing by chewing on them. It is not an uncommon sight to see an old woman with her teeth worn down to the gums from chewing upon seal and caribou skins.

SUMMER is the happy time for the Eskimos, for as soon as the sun is high they move out of their snow houses and into their summer houses or *tupiks*, which are made of sealskin. The rivers and the sea teem with Arctic trout, salmon, seals and walrus. The Eskimo always takes his share of ducks and geese as they fly north on the way to their nesting places on the tundra lakes. The polar bear is no longer a menace and is easy to kill in the water or on the small ice pans. He, too, has plenty to eat, and the fear of having a big polar bear crashing into an igloo looking for food is over for a time.

The Eskimos have two kinds of native boats. One is a large boat in which all the family can ride, as well as numerous dogs. This is called an *umiak* or "woman's boat," and is made of sealskins sewn together and lashed



SUMMER CLOTHES

An Eskimo male dressed in the sealskin suit that is the standard summer costume

around a framework of whale ribs and driftwood. It is a sea-worthy craft, and with a square sail made of intestines and with a fair wind it travels swiftly up and down the coasts.

THE man's boat is called a *kaiak*, and he uses it for hunting. This craft, usually only about three feet wide and ten to fifteen feet long, is probably the most sea-worthy and effective small boat in the world. Made of driftwood covered with seal skins, it has only a small hatch left in the top for a man to crawl into. He sits on the bottom of the boat and lashes his water jacket, made of some water-proof skin, to the gunwale of the hatch. The sleeves of his jacket are then tied about his wrists and the hood pulled tight under his chin. He is then practically shut in, so that although water may pass entirely over him, scarcely a drop enters the craft. He propels himself swiftly with a paddle, in most cases a double one. If the *kaiak* should happen to tip over, it is perfectly all right with the Eskimo, for with a flip of his paddle he rights it and travels merrily along. I have seen them spin their *kaiaks* in the water like a pinwheel.

Walrus hunting is probably the most dangerous occupation for the *kaiaker*, as it often happens that a wounded walrus will turn and attack the hunter. If he does this, a thrust from a lance sometimes will stop him, but if it does not, and he tears the thin skin of the boat with his sharp pointed tusks, the Eskimo is out of luck, because few Eskimos can swim even if they could cut themselves loose from the boat. As a rule two men travel together on a walrus hunt, and if one boat is attacked, the other man endeavors to rescue his companion. It is a difficult task, however, for if one walrus in a herd attacks,

WOMAN AND BABY

Within the wide hood sleeps the baby.
See also illustration at bottom of page 105

ESKIMO SUMMER CAMP

Although the traditional home of the Eskimo is the arched *igloo*, it is used only in winter. In summer, they move to their *tupiks*, which are summer homes covered with sealskin

all the others seem to think it is the proper thing to do, and act accordingly. Then the hunters have to do some tall hustling to get away from that locality, if they want to live to hunt another day.

Whale hunting is the true test of skill for the *kaiaker*, and when a number of Eskimos in their little hundred-pound boats put their harpoons, with floats attached, into a twenty-five ton whale, all kinds of things can happen, and most of them are unpleasant for the hunter. But the Eskimos have to live, and when they see a whale they go after him, and often tow him home to the beach for their waiting families and dogs.

The clothes worn by the Eskimo are the only practical garments to use in the cold Arctic winter, and they have been adopted by all successful explorers of the north. In general it is the most complete costume worn by American natives. Dressed skins of the caribou are preferred for clothing, but fur skins and pelts of birds sewed together are also used. In various regions the costumes present tribal differences in cut and ornamentation. In Alaska the costumes are quite similar, but the woman's coat is provided with a large hood and her leggings are made into one garment with the moccasins, while the men wear breeches and long boots. Two suits of clothing are always worn in winter, one with the hair next to the skin, and the other with the hair turned out.

AMONG the so called "blonde" or Copper Eskimos, who live west and north of Hudson's Bay, both men and women wear coats with long tails down the back. These look very much like the formal dress coat worn in civilization. Among these people the only way I could tell a man from a woman was by the size of the hood on the coat. A woman's hood is made large because children are carried naked against the mother's back until they are old enough to walk and take care of themselves.

In south Greenland, Eskimo women dress in dyed sealskin garments in summer; blue and red seem to be the favorite colors. Some of these costumes are elaborately and beautifully decorated with masses of beads.

IN north Greenland, blue and white fox skins are used for clothing. Often a suit of clothing from this region would have a market value of about 1000 dollars in civilization for the skins alone. The men of the region prefer to have their trousers made of polar bear skin, as it does not tear as easily as fox.

Living for centuries under extreme conditions, the Eskimos have survived untold hardship, increased in numbers and maintained a cheerful and friendly disposition through it all. Any normal white man who has been in contact with them respects and admires their many fine qualities. Naturally, their morals and manners are difficult for a person reared in the knowledge of a different code. Honesty is inculcated in the young and is exacted by all the Eskimos. A murderer is often put to death by the friends or relatives of the murdered person. Truth, honesty, and the safeguarding of human life could be the slogan of the Eskimo, for they are recognized as essential to the peace and prosperity of all. As a whole the Eskimos I have met, who are supposed to be uncivilized, can teach white men much respecting the happiness and well-being of others with whom they come in contact.

Our Point

Welcome Home

HENRY FORD has entered into a contract with the state of Para, Brazil, under the terms of which he has been granted a concession of 3,700,000 acres of land to be developed into a rubber plantation. The Ford Industrial Company of Brazil which was organized to exploit the concession and which has Edsel Ford as its president, contracts to plant rubber trees at a specified rate per year and obligates itself to pay a percentage of the profits after the first 12 years to the state of Para and the municipalities within the borders of the concession. In return, the company is to be exempt from taxes for 50 years, import duties on machinery and equipment, and is authorized to construct warehouses, docks, factories, schools, and whatever other buildings may be necessary, and is allowed to export its rubber without supervision.

For many reasons, the return of rubber to its original home has been joyously acclaimed by the western world. Perhaps the greatest reason is that, although 78 percent of the world total of 29,505,475 motor vehicles—using tremendous quantities of rubber—are in the United States, this country has been dependent for its rubber upon an outside monopoly. Now, with rubber being cultivated on an extensive scale in Para, from whence the original seeds that started the East Indian plantations were taken, some hope for relief may be seen. Results will not be immediate for it takes years for rubber trees to reach productive age and, of course, a plantation must be developed slowly, but it is possible that, in years to come, an amount of rubber at least sufficient to compete with that produced by foreign enterprises and to hold the price to a reasonably low level, may be produced by this American company for American users.

Dangerous Wastes

PROMPTED by the presence of waste crank-case oils in large quantities in the sewers of the District of Columbia, the Engineer Department of the District began in January, 1928, a survey of cities in this country, Canada, and several European countries respecting the disposition of such wastes at garages, filling stations, and automobile repair shops. It had been ascertained that such drainings into the sewers contain an amount of gasoline sufficient to vaporize and thus create a fire and explosion hazard upon coming in contact with hot wastes from laundries, hotels, et cetera.

Engineering Fundamentals

WE were pleased, indeed, with the pronouncement in the inaugural address of Stevens Institute's new president, Dr. Harvey N. Davis, that, hereafter, this honorable old institution will build foundations in general engineering principles instead of giving specialized courses. Following on the heels of, and a step over and above, the thought conveyed in our editorial in August, 1928, which urged a prolonged period of training in the fundamentals of engineering and a broader, general background before specialization, Dr. Davis' plan receives our unqualified approbation.

To show why Stevens Institute is adopting this tradition-shattering plan, Dr. Davis cited the case of a large technical school which offers 43 specialized courses. Obviously, he said, it is impossible to train a student to be 43 kinds of an engineer; and to give him an education in but one is highly undesirable. An attempt to do the first would make of his mind a machine-like hodge podge, while the latter course would so restrict his vision that he would be seriously handicapped. While the period of specialization is said to be in a moribund state, if the student wishes to concentrate his thoughts and energies in a single direction, he should not do so until he has "generalized" a great deal.

Engineering schools throughout the country will, no doubt, watch this far-sighted plan being worked out at Stevens Institute, and when it has proved successful—as we confidently expect it will—some of them will be jealous of Stevens for having planned and adopted it first.

The questionnaire to city engineer departments elicited the information that they all realize the seriousness of the question, that 70 percent of them prohibit the disposal of waste oils in the sewers and that 25 percent do not prohibit it; 5 percent made no definite answer to the question. The facts that 65 percent of these cities reported trouble from oil in sewers and 35 percent reported fires and explosions, indicate that the situation requires more thorough study than has yet been given it.

Cities in America that are today utilizing waste crank-case oils, report the following ways of using it: for burning city garbage, in the manufacture of paints, for oiling concrete forms, as fuel oil, for the extermination of mosquitoes in swamps, for oiling dirt roads, and, when re-refined, for lubricating automobile engines. With this great variety of uses for these dangerous wastes, every city in the country should take measures to control the dumping of oil, should, in fact, make good use of the oil commercially. As the problem is aggravated by the increase of cars, many opportunities for the establishment of a paying industry in saving used oils will be seen by energetic, far-sighted men. Such businesses are already in operation but the field has only been touched; let others start similar ones and rid their cities of a menace while earning profits.

Sea Safety

"SEAMEN without schooling in the fundamental code of conduct at sea and without a sense of discipline" is said, by some of the survivors of the *Vestris*, to be one primary reason for the great loss of life when that vessel foundered and sank in November, 1928. It is claimed that if the men had possessed a finer sense of loyalty to their duty—had not been of the class of "wooden men in iron ships"—a greater number of people would have been saved. This, however, is a psychological incidental.

The main issue is: "Why did the ship meet disaster?" Following this, comes the question: "Why was the life-saving equipment not sufficiently fool-proof to enable the passengers to save themselves regardless of the efforts of the crew?" As to why the ship sank, perhaps no reasonably definite answer will ever be obtained, but to the second question, the answer is simple: there is an urgent need for new and more efficient life-saving equipment.

The problem of reducing the hazards of the sea, recently given much prominence in connection with the loss of the *Vestris*, will now be studied more intensely than it has been since the sinking of the *Titanic*. Already,

# of View

awards are being offered for better life-saving apparatus (see page 121) and, during the coming spring, an International Conference On Safety Of Life At Sea will be held in London. At this, the first sea-safety conference since the incomplete one in 1913-1914, it is expected that the question, in all its complex ramifications, will by studied thoroughly. Revision of sea codes pertaining to the conduct of officers and crew, to the adoption of new apparatus, to ship inspections, et cetera, may be the result of this conference.

It is almost an assured fact that shipping may expect greater sea safety as the outcome of the cerebrations of the many minds now occupied with it. However, those whose duty, business, or pleasure carries them in ships, either continually or periodically, will look forward to the development of apparatus that will save them, whether or not life-boat drills have been perfunctory, inspections lax, and officers and crew negligent.

Political Water-Power

AT last a modern Socrates has spoken for the people. Thomas A. Edison has, in effect, challenged those politicians who have been misleading the public with fatuous arguments about the supreme importance of water-power and its control by the government, to "define their words." But he has done more than that; he has himself defined their words and dispelled a harmful illusion. According to Mr. Edison, water-power can never take the place of fuel for the generation of electricity.

Numerous stock arguments such as: "water runs down hill and costs nothing while fuel must be mined, transported, and burned; the waterfall is a manifestation of great energy without apparent effort; water-power is America's greatest natural resource and can never fall into the hands of the 'interests' if the people are only intelligent enough to prevent them from doing so!" were deprecated by Mr. Edison. Of the factors entering into the question, he cited the following: the tremendous first cost of a hydro-electric station which must be wholly completed before its power can be sold in a distant market, this cost including the price paid for land for the plant and dam, investment in material and equipment, and the cost of construction of the dam, plant, and many miles of transmission line.

Contrasted to this, a steam plant has a low first cost because it can be built a unit at a time as the market demands and requires no dam and usually almost no transmission lines. Operation of a hydro-electric plant depends upon seasonal flow of water and requires, for economy, a close tie-in with fuel-burning plants. About 72 percent of the country's water-power resources are in a territory embracing only 21 percent of our power-requiring industries, most water-power being in inaccessible mountainous regions. Furthermore, whereas in the early days of water-power development, fuel-burning plants used three or more pounds of coal for every kilowatt-hour of electricity generated, the best plants today use less than one pound. Also, steam turbines are more efficient.

To the "Calamity Ann" who continually cries that our coal will soon be exhausted, Mr. Edison points out that, despite the enormous amount of coal we have already used, only 1 percent of the available supply has been mined. Coal, therefore, "will carry us on indefinitely into the future and then, as now, water-power will be quite inadequate to meet the demands for electrical power."

At this point, the obvious quotation to make, were it not so trite and threadbare with use, is that which relates to "fooling all the people all the time." Mr. Edison's remarks, however, stand on his great fame and reputation: comment is unnecessary. Those "intelligent" people mentioned above may draw their own conclusions.

Save Your Life

THE United States is rapidly becoming a despotism, the despot being the speed demon which invests the minds of all of us on occasion. Yet this desire for speed is more than a state of mind: it is an incubus which harasses, usurps the seat of logic, and drives us on with plausible arguments interlarded with such words as expedition, efficiency, et cetera, ad infinitum. A great many of us realize the fallaciousness of these arguments and yet ignore them because, perhaps, we have some doubt regarding our own reasoning; we feel that we *may* be left behind.

Proof to show us positively that speed is often a saver of so little time as to be absolutely unnecessary, is offered by the American Road Builders' Association. This association cites a test made by a Chicago taxi-cab company to show the futility of unreasonable speed as a means of gaining time. "Two cabs were started simultaneously, destined for a point nine miles distant, over a main thoroughfare of that city. One traveled at top speed and the other at a reasonable speed. The speeding cab arrived at its destination only four minutes prior to the arrival of the safety cab. Dozens of hazards were created (by the faster cab), lives were endangered, property imperilled, and laws violated—all for four minutes time."—!!! We have quoted the association; the exclamation marks are our own.

Only one thing further need be said: if you value a saving of one half a minute per mile more than you value the 30, 40, or 50 years you expect to live, then by all means, speed! Automobile hearses are much faster than the old horse-drawn ones.

Dispelling the Gloom

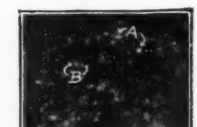
TOO many people committed suicide by jumping into the Thames from Blackfriars Bridge. London authorities became alarmed. What was to be done? After careful consideration, a practical application of psychological laws was decided upon as being the remedy or, rather, the preventative. The somber black, the sad and death-like hue of the old bridge, was done away with and in its stead, there burst forth upon the astonished gaze of the throng, a bridge that was a thing of living, breathing color; it had been painted light green trimmed with bright yellow. What the result of this psychological experiment may be there is no way of predicting. Possibly it will serve its purpose: the "happy" combination of colors may turn many a gloomy person away with a smile. But that smile may be one of amusement, and then again it may not be. Some attic artist, despairing of success for his canvases in the lying style so earnestly praised by Oscar Wilde, may come to die, rub his eyes, look upon this as a modernistic daub and the supreme affront to his art, and go away with a grim smile that promises revenge.

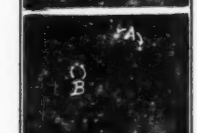
What Things Are Made Of—I

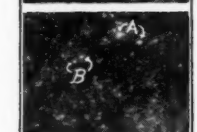
The New Physical Concept of the Universe. It is a Composite of Three Things—Protons, Electrons, and "Photons"

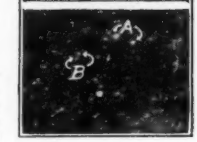
By ARTHUR H. COMPTON, Ph.D.

Professor of Physics, University of Chicago.
Member American Philosophical Society; National Academy of Sciences; National Research Council. Nobel Physics Prize Winner, 1927









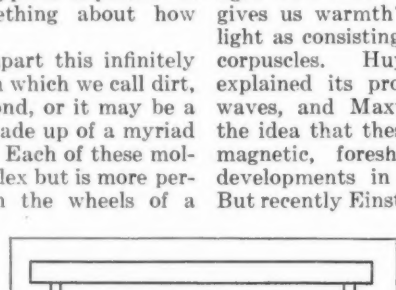
MOLECULAR JAZZ

Figure 1: Four successive "movie" pictures of oil particles suspended in water, magnified 2700 diameters

WHO is there who has not asked himself, "What is this world around me?" Rocks, trees, people—what are the parts of which they are made, and how are these parts put together? Light, radio waves, X rays—what are these radiations?

Upon such questions men have pondered since the beginning of thought. Until recently, opinions on these matters were speculative; but during the last heroic generation many of these questions have been answered with a definiteness which was unthinkable in an earlier era. It will not be possible in this brief survey to present adequately the great mass of evidence which has been collected regarding the nature of things. We shall rather discuss only a few typical experiments that tell us something about how things are made.

When we take apart this infinitely complex mechanism which we call dirt, or perhaps a diamond, or it may be a flower, we find it made up of a myriad of tiny molecules. Each of these molecules is itself complex but is more perfectly formed than the wheels of a watch, and has continued to run for billions of years without winding and without wear. We find that the molecules which make up matter in all its endless variety of forms are themselves built up of a few hundred kinds of atoms. Some of these atoms differ from each other by their chemical properties, others only in one respect, by their weights.



CLOUD MAKER

Figure 2: When piston is pulled down, the air in the chamber expands and cools

But we cannot stop here. Our few hundred atoms are themselves made of yet more tiny particles. It is as sung by the poet Pope:

"The larger fleas have smaller fleas
Upon their backs to bite 'em.
These smaller fleas have other fleas,
And so ad infinitum."

These tiny particles show themselves through their electric charges. There are found to be two kinds of them, carrying positive and negative electric charges, respectively. But as nearly as we can tell, all those of any one kind are exactly alike. The positively charged particles, called *protons*, have most of the weight of the atom, while the negatively charged particles, or *electrons*, are the lively little bodies responsible for chemical combinations, electrical conductivity, and the like. By grouping themselves in various ways these little particles form the various atoms.

ROCKS and trees and people do not, however, make up the whole of the universe. How about the sunlight that makes the trees grow and gives us warmth? Newton wrote of light as consisting of little particles or corpuscles. Huyghens and Fresnel explained its properties in terms of waves, and Maxwell, by introducing the idea that these waves are electromagnetic, foreshadowed the recent developments in X rays and radio. But recently Einstein has brought back a modified conception of Newton's light corpuscles, now called *photons*, and evidence for their existence has become convincing.

At the present moment, light is the darkest of the physicist's problems. It seems that we can prove that it consists of waves; but we can also show that it consists of little particles. The two conclusions cannot really be inconsistent; but how light can consist of waves and at the same time of tiny particles is as yet an unsolved riddle.

Just a century ago a botanist named Brown was examining some tiny objects suspended in water under a high power microscope. "They're alive," he exclaimed. But to make sure, he turned his glass on some wax particles suspended in the same way, and found that they also moved. Everything that is small enough moves, he found, unless it is held fast to something solid. These are the "Brownian movements." It is as if a swarm of little "Brownies" were pushing the globules hither and thither. In Figure 1 is shown a series of moving pictures of these motions, taken with the ultramicroscope. Notice the motion of the particles *A* and *B*. The smaller particles move faster than the larger ones. Under the microscope the Brownian motion has the appearance of a jazz dance on a crowded floor.

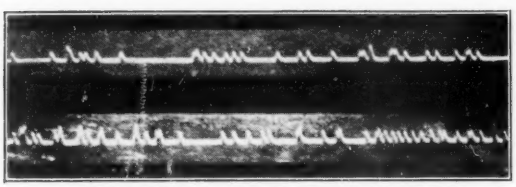
WHAT is the cause of this motion? For many years physicists had explained the pressure of a gas on the walls of a vessel which holds it by supposing that the gas is made of little particles, the "molecules," which dart about in the gas at high speed. They could calculate how fast these molecules must go to account for the observed pressure, and found that if the energy of their motion was proportional to the temperature, they could account accurately for the increase of pressure with temperature. The calculation showed too that the energy of motion of the little molecules should be the same as that of the big molecules, which would mean that the little ones must move faster.

Now a careful study of these Brownian movements, such as those shown in Figure 1, reveals the fact that the energy of motion of these particles under the microscope is just what the kinetic theory says a molecule should have. And the speed of their motion increases at higher temperatures, just as the molecular theory predicted. At one instant more molecules strike a globule on one side, and the next instant more strike on another. In

fact, in a very real sense, one may correctly consider the motion of these little particles as true molecular motions. We must remember, however, that these globule "molecules" consist of perhaps a million atoms each.

Such things as this show us that our idea of "dead matter" is indeed far from the truth. We have a glimpse of the continual activity in things we call dead.

Not long ago a group of us were camping beside a frozen lake in the Himalaya Mountains, 13,000 feet above the sea. The lake was surrounded on three sides by mountains. At about the middle of the day, when the wind was blowing over the mountains, one could see clouds gathered about their peaks, clouds which evaporated almost as soon as they were formed. On one side of the mountains the clouds could be seen rising with the air, and becoming more dense as the air expanded at the higher levels. On the other side, where the air was coming down, the clouds, being compressed at the lower levels, gradually evaporated into thin air. The air was so cooled by expansion when it was rising that the moisture condensed into clouds, which would then evaporate as soon as the air sank to a lower level and became warmed by compression.



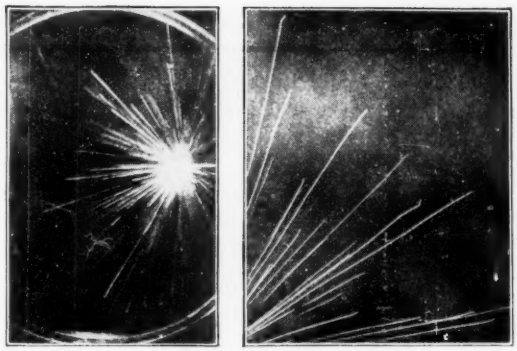
COUNTING ALPHA PARTICLES

Figure 4: A record of the alpha particles entering a counting chamber connected to an electroscope (Rutherford)

Dr. C. T. R. Wilson tells me that it was while watching a phenomenon of this kind in his native hills of Scotland, that he conceived the idea of making artificial clouds by allowing moist air to expand. This study quickly revealed the fact that it is very difficult to make a cloud form unless there is something in the air, such as dust particles, which may act as nuclei for condensation. Even at a high mountain peak, the fact that a cloud forms indicates that there are some dust particles, although perhaps excessively minute, floating in the clear blue air.

IT is possible, however, to remove the dust from air. The air may be filtered through cotton, or if the water droplets in the cloud are allowed to fall as rain they carry the dust particles down with them. When the air has thus been cleaned, Wilson found that the cloud would condense on ions if any were present. Ions are the electrically charged pieces of broken atoms or molecules. The "alpha rays" from radium were known to produce ions in the air through which they pass. So Wilson tried the experiment of making clouds condense on the ions produced by alpha rays.

The apparatus which he used in this experiment is shown diagrammatically in Figure 2. There is a chamber with glass top and sides, which is closed at the lower end by a movable piston. This chamber is filled with air, saturated with moisture. The piston is suddenly moved downward to give the proper degree of expansion, but no cloud forms, because the air has been carefully freed from dust. Then alpha rays are allowed to shoot from a speck of radium placed in the chamber, and a cloud forms on the ions produced.



MORE ARTIFICIAL CLOUDS

Figure 3: Two photographs of the cloud formed in air ionized by alpha rays shot out from radium (Wilson)

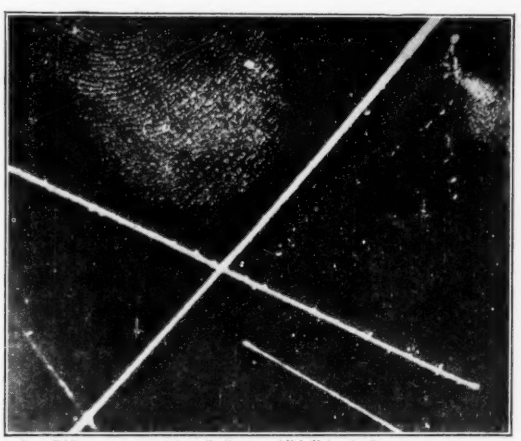
Two photographs which Wilson took of the clouds thus formed are shown in Figure 3. Instead of a diffuse cloud surrounding the radium, we see a group of sharply defined lines radiating from the source. We see that the alpha rays do not spread uniformly in all directions but are concentrated along definite, straight lines. The interpretation is clear. These rays are little particles which shoot through the air at such high speed that they break in pieces the molecules through which they pass, leaving ions to mark their trails. The ions are in turn made visible when droplets of moisture condense upon them. Each of these linear clouds thus marks the path along which traveled one of the particles ejected from the speck of radium. For want of a better name we shall call the thing which is responsible for such a track an "alpha" particle.

BUT what are these alpha particles? The question has been answered in a striking manner by Rutherford. He surrounded a strong radium preparation by a glass vessel with walls so thin that the alpha particles could pass through. After a long period of time he found that a gas was accumulating where the alpha particles were collecting. This gas was compressed into a small tube and its spectrum examined. Its spectrum was found to be exactly like that of helium gas. In other words, these alpha particles were found, when collected in large numbers, to constitute helium. We may call them, then, *atoms* of helium.

Using this method of collecting alpha particles or helium atoms it is possible to estimate in a very direct manner the number of atoms in a given volume of gas. We can count directly the number of alpha particles ejected from a weak preparation of radium. This might be done by counting the trails of the alpha particles in photographs of the type shown in Figure 3.

A BETTER method, however, is to count them electrically, using a sensitive electroscope which records each alpha particle as it enters a small chamber. Figure 4 shows a record which Rutherford obtained in this manner of the alpha particles escaping from a weak source of radium. Of course the number of alpha particles is proportional to the amount of radium, so by comparing the strength of the radium preparations the number of alpha particles in the gas collected in the spectrum tube can be estimated.

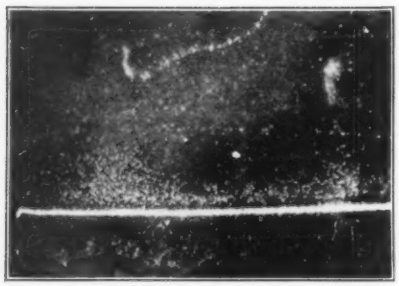
The number thus determined is a perfectly tremendous one. It means little to say that in a thimble full of helium there are atoms to the number of 3 with 19 ciphers after it. Let us suppose that we could paint each of the molecules in a thimble full of water



From Eddington, "Stars and Atoms". Courtesy of Yale University Press

TWO CLUES

Figure 5: Would you deny the existence of the maker of the finger print because the print was all you could see?



THREE TRAILS

Figure 6: Trails of an alpha particle (helium atom) and two beta particles (that is, electrons) shot out from radium

green. Let us now spill this water on the ground and wait for thousands of years until it has flowed to the sea, has re-evaporated and rained over the earth so that our water molecules are distributed all over the world. Then wherever we should go each drop of water that we should examine would probably have in it one of the green molecules from the original thimble.

But perhaps you will say, "Show us the atom and we will be satisfied." Let me ask you, then, what is the spot in the corner of Figure 5? If you answer, "It is a man's finger," I shall reply, "Then the heavy white lines across the paper are helium atoms."

BUT if you are more cautious and tell me that the spot is the print of a man's finger I shall be equally careful and state that the white line is merely the print left by the helium atom.

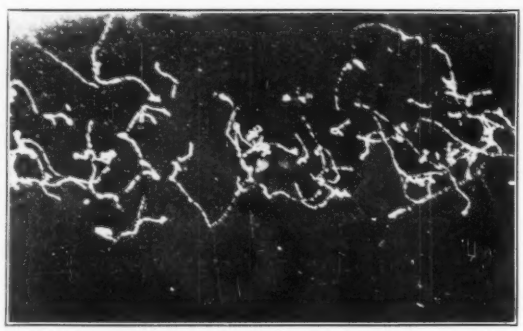
The story is told that toward the close of the 19th Century one of Lord Kelvin's students approached him with the question, "What do you think of this new theory that the atom has structure?" "What!" said Kelvin, "the atom has a structure? The very word 'atom' means the thing that can't be divided. How then can it have a structure?" The insubordinate youth is said to have replied, "That shows the disadvantage of knowing Greek."

In Figure 6 is shown the trail of an alpha particle, and above it two fainter trails, one crooked and the other straight. From their appearance one would guess that these fainter trails are due to objects much smaller than the alpha particle. But the alpha particle itself, as we have seen, is an atom of helium, which is next to the smallest atom that we know. What then can these other particles be? Let us call them "beta particles" to avoid any suggestion as to their nature. In Figure 7 are shown such beta particles knocked out of air by the action of X rays. It is found that they can be ejected from anything. They are, that is, a common component of all different forms of matter of whatever nature.

The photograph shown in Figure 8 was taken with a strong magnetic field applied to the expansion chamber when a cloud was formed. It will be seen that the trails of the beta particles are curved in circles. Such a bending of paths is just what we should expect if the moving particles were electrically charged. For a magnetic field produces a force on a moving electric charge just as it does on a wire carrying an electric current. From the direction of the curvature one can show that the charge carried by the particle is negative. If we can measure the magnitude of this charge it will be possible to tell from the curvature of the trails what is the mass of the beta particles.

No one has been able to devise an electroscope sensitive enough to measure the very minute charge carried by one of these beta particles. But Millikan has measured their charge in a most interesting manner. He caught a tiny droplet of mercury between the electrified plates of a condenser and threw a beam of ultra-violet light on the droplet. The effect was to eject a beta ray from the droplet. The droplet was left with a positive charge equal to the negative charge carried away by the beta particle, and the electric field of the condenser could be so adjusted that the force on the droplet's charge would just balance its weight. Knowing the weight of the droplet, it was thus possible to determine its charge. It was found that each beta ray which left the droplet carried with it the same negative charge, a charge equal in magnitude to that carried by a hydrogen ion in electrolysis.

Having thus found that the charge carried by a beta particle is the same as that carried by a hydrogen ion, magnetic deflection experiments such as those shown in Figure 8 indicate that the mass of the beta particle is only 1/1845 that of a hydrogen atom. We were thus right in our guess that these beta particles are things much smaller than the smallest known atom. Since we find that such particles can be removed from every kind of matter, it follows that they must be one of the components of which atoms themselves are built. We shall now give to these beta particles the name of *electrons*.



RESULT OF COLLISIONS

Figure 7: Beta particles (electrons) produced by X rays passing through air and knocking them out of atoms

IT is not possible to suppose that atoms are constituted solely of electrons, for electrons have negative charges, and atoms are electrically neutral. The atoms must, therefore, have some positive charge as an essential part of their structure. An examination of the trails of alpha particles such as those shown in Figures 9 and 10 give an important clue to the distribution of the positive charge within the atom. Let me call attention to the pair of tracks in Figure 9, one of which goes nearly straight and the other of which has two rather sharp breaks. It is really a most remarkable thing that this one track is so straight, since a simple calculation shows that in the portion of the track shown in this figure the alpha particle has passed through some 20,000 atoms. But we have seen that the alpha particle itself is nothing but a helium atom with a double positive charge. This photograph therefore means that while the helium atom is passing through the oxygen or nitrogen atoms of air, we have repeated 10,000 times the most unusual phenomenon of two bodies occupying the same space at the same time.

Occasionally, however, the alpha particle strikes something so hard and immovable that it must change its course. From the fact that there is only about one such collision for every 10,000 atoms traversed, it is clear that the object struck is much

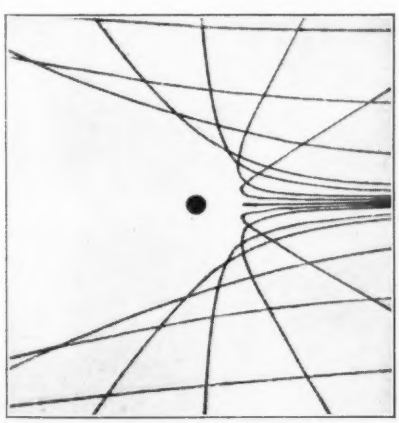
CURVED PATHS

Figure 8: A magnetic field attracts a moving electric charge, whether it moves in a wire or in free space

smaller than the atom itself. Further, the manner in which the impinging helium atom glances off shows that the object is heavier than an atom of helium. It is not, however, a collision with a stone wall. You see in Figure 9 that the particle struck by the alpha ray itself rebounded and left a little track.

Figure 10 shows a similar event more clearly. From the relative length of these two tracks it seems probable that the object struck has a mass several times that of the helium atom, or about that of the oxygen atom. Collisions of this character indicate that there must be something within the atom hard and impermeable, very much smaller in size than the atom itself, yet possessing practically the whole mass and weight of the atom. This something, whatever it may be, has been named the atomic *nucleus*.

IT has been shown by Rutherford that the atomic nucleus deflects an alpha particle as if the force between them were one of repulsion between two electric charges. On this view the paths of alpha particles passing a nucleus should be as shown diagrammatically in Figure 11. All of the particles are bent slightly, but only those coming close to the nucleus are bent through a large angle. It is obvious that if the charge on the nucleus is large its effect will extend to a greater distance. That is, the nucleus will act as a larger obstacle and the number of collisions will be



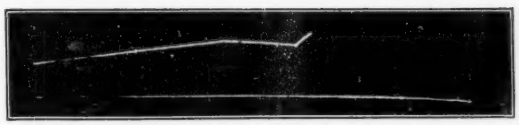
THEORETICAL PATHS

Figure 11: Reflections of charged particles shot toward a charge of the same sign

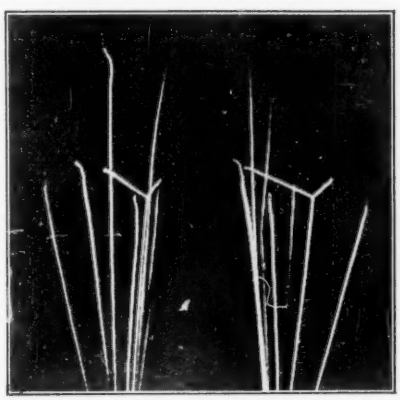
greater. So by counting the number of collisions occurring when a group of alpha particles passes through a known number of atoms we can determine the charge on the nucleus. Measurements of this kind have shown that the nucleus of the hydrogen atom has a positive charge equal to that of one electron, helium that of two, lithium three, and so on down the list of chemical elements to uranium with a charge equal to 92 electrons on its nucleus.

A PARADOX?

Figure 9: The "paradox" is stated in the text. The answer is: the atoms consist mainly of emptiness



This discovery suggests that the nucleus of the atom may be built up of units carrying a positive charge equal to the negative charge of the electron. Such a unit we find in the nucleus of the hydrogen atom. It is perhaps surprising that the positive unit of electric charge should be associated with a mass almost 2,000



TWO CARROMS

Figure 10: Double photograph of a collision of alpha particle with oxygen atom

times as great as that associated with the negative unit.

Rutherford has, however, performed a series of experiments which gives good reason to believe that our guess is correct. These experiments consist in shooting alpha rays from radium through various substances. It is found that particles having the same charge and mass as the hydrogen nucleus can be knocked out of some of the lighter elements. An event of this kind is shown in Figure 12, a remarkable photograph taken by Mr. Blackett. We see here the impact of an alpha particle with the nucleus of a nitrogen atom. There is a thin trail left by the hydrogen nucleus escaping from the nitrogen nucleus.

Similar results are obtained when alpha particles traverse boron, aluminum, phosphorus and certain other light elements. It would seem that the only reason that hydrogen cannot be liberated from other elements by such methods is that our hammer, the alpha particle, does not strike a sufficiently powerful blow.

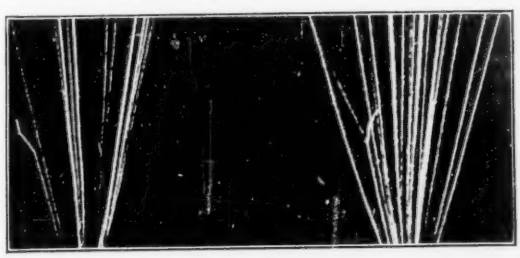
The evidence thus seems very strong that the nuclei of the various atoms are indeed built up of an aggregate of hydrogen nuclei, which we shall now call *protons*, cemented together with electrons. In the case of oxygen, for example, the nucleus presumably consists of 16 protons, corresponding to the fact that the oxygen atom weighs 16 times as much as hydrogen. To hold these protons together, there will be eight electrons, leaving a resultant positive charge on the nucleus of eight units.

IT is this nuclear charge of eight electronic units which is detected by the alpha particle deflections, such as those in Figure 10. Around this nucleus, arranged as a sort of atmosphere, will be distributed eight more electrons, making a neutral atom. These outer eight electrons are responsible for the ordinary physical and chemical properties of oxygen.

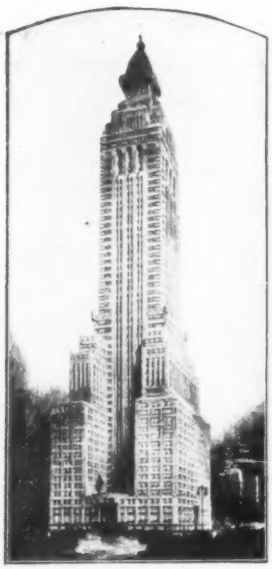
¶ In the second part of his fascinating article, to appear next month, Dr. Compton will conduct the reader through a lucid discussion of some of the newer aspects of physics, to which the discussion in the present article is more or less introductory: whether, for example, light consists of waves in some medium conveniently labelled "the ether," or whether it is something corpuscular, as Newton believed; the Einstein interpretation of the theory of the emission of photo-electrons, which carried us far but not far enough; the peculiar alteration in wavelength of reflected X rays, and finally the paradox of electron-waves, involving the new wave mechanics which have not attracted so much attention. He will explain and interpret the recent revealing experiments of Professor G. P. Thomson of the University of Aberdeen, which have already gone far to demonstrate the accuracy of the new wave-electron concept. Altogether, the discussion is a most notable one.—The Editor.

MODERN ALCHEMY

Figure 12: A double photograph of an alpha particle knocking a hydrogen nucleus (proton) out of a nitrogen atom (Blackett photo)

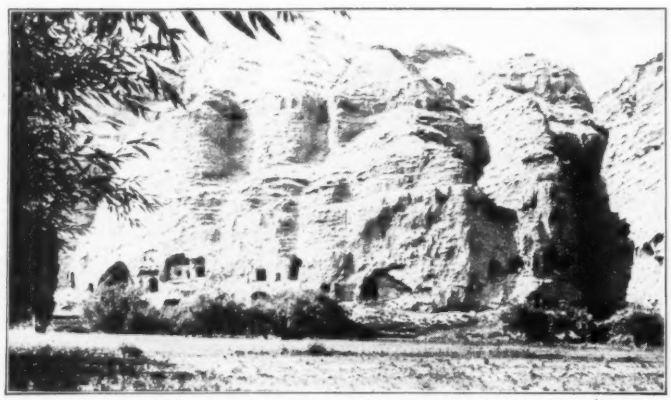


From the Scrap-book of Science



808 FEET HIGH

When the Chrysler building, in New York City, is completed in 1930, it will be one of the three or four tallest buildings in the world. Its cost will be about 14,000,000 dollars, and in many ways it will surpass any other building



PRESENT-DAY "PRIMITIVE" DWELLINGS

Hundreds of semi-savage tribesmen of eastern Turkestan reside in "apartment dwellings" such as this, cut into solid rock. Each "apartment" is separate, has its own entrance door, and in most cases consists of but a single room, very simply furnished

TANK-LOOKOUT

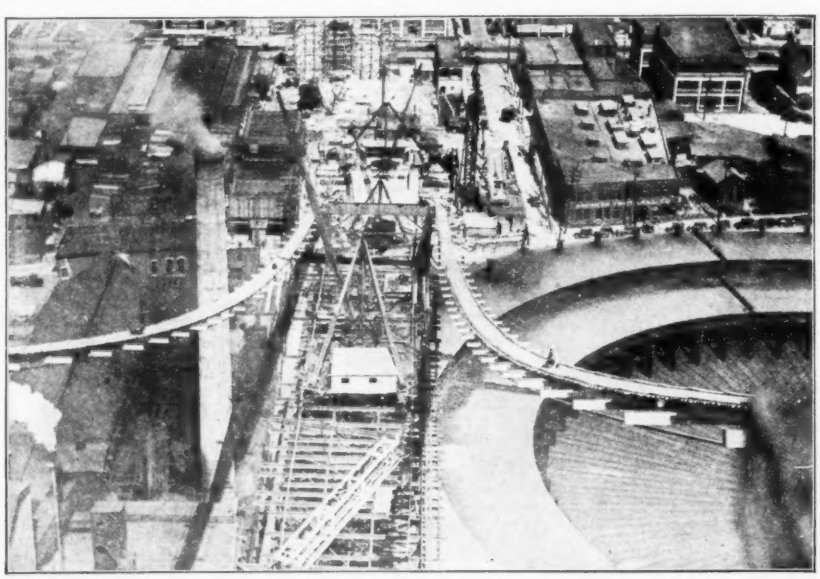
This combined water tank and lookout tower is at Wentz Camp, a Boy Scout camp near Ponca City, Oklahoma. The spherical portion holds 30,000 gallons of water. The cylindrical portion is 75 feet high and encloses a stairway

IT WRITES JAPANESE

Due to the great number of characters in written Japanese—about 100,000—it has been difficult to construct a typewriter for the language. The one shown here, being operated by Miss Kotoji Sato, was invented 14 years ago but only recently made practical by the condensation of the characters to 3000. It is being used extensively by many Japanese who are engaged in business in United States

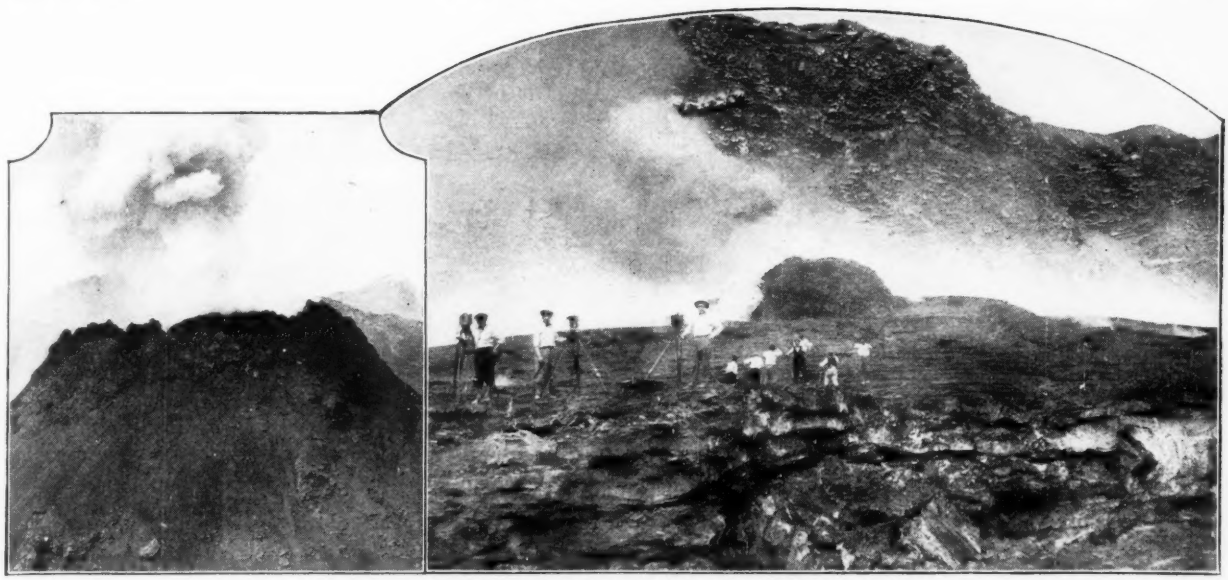
MEASURING RAILROAD JOLTS

In order to determine any defects in the balance of railway cars, the London and Northeastern Railways uses this Hallade track register. Clockwork controls a roll of white paper on which three pointers record oscillations due to car unbalance or track variations



INTERNATIONAL BRIDGE ➤

The city of Detroit was connected with Canada recently when two pairs of one and seven eighths inch steel cables were installed between the towers of the new bridge that is rapidly nearing completion across the Detroit River. This view was taken from a tower and shows the catwalks.



A PERIODIC DISTURBER OF THE PEACE

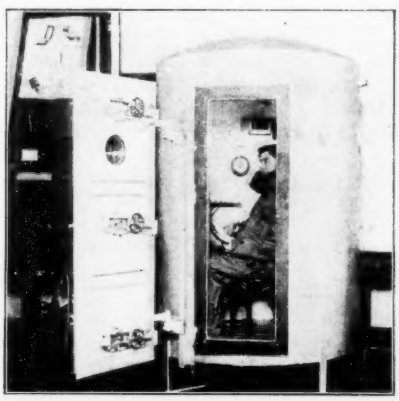
Two views of famous Mount Vesuvius which is reported to be more active than usual following the quieting down of Etna, the recent great lava flows from which entirely destroyed several Sicilian towns. The central crater of Vesuvius, shown in the photograph at the left, smokes constantly and from time to time ejects great masses of molten lava. These lava flows are not dangerous, however, since they are confined to the interior of the huge main crater. Volcanologists study Vesuvius constantly. The photograph at the right shows a group of photographers in the crater picturing the activity

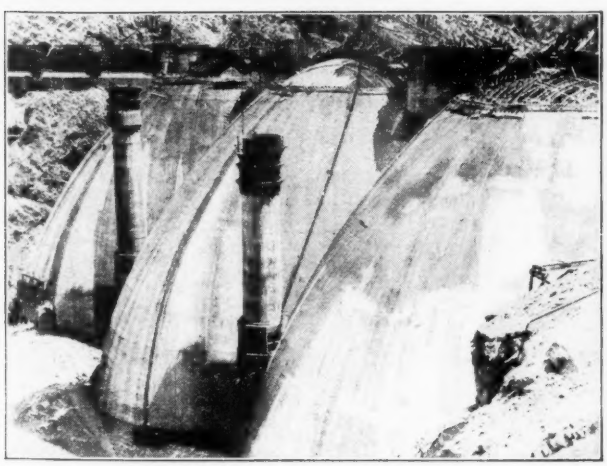
NOW IN SERVICE

The Oakland-Alameda, California, estuary tunnel described in SCIENTIFIC AMERICAN May, 1928, is now in operation. The photograph shows an operator on duty at the automatic indicator and control board at the Oakland portal. Indicators on the board keep the operator informed as to the operation of all the machinery in the tube

FOR ACCURACY AND SAFETY ➤

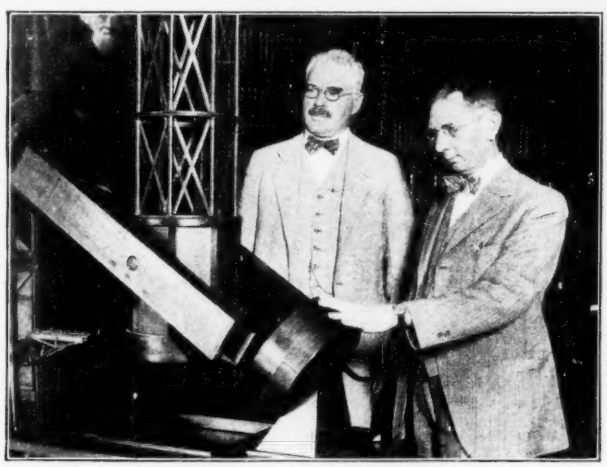
A new vacuum chamber which the United States Bureau of Standards is now using for correcting the various measuring instruments used on airplanes. This view shows how the instrument checker works except that, in operation, the door is closed and the operator wears an air mask





COOLIDGE MULTIPLE-DOME DAM

In this unique dam, engineers pioneered in the construction of domes involving curves in both the vertical and the horizontal planes. The dam, which is on the Gila River in Arizona, was completed nine months ahead of schedule time—a record, it is said, for government work



FOR SCANNING THE SKIES

Dr. Francis G. Pease and Dr. John A. Anderson, both of the staff of Mount Wilson Observatory, standing beside a model of the proposed 200-inch telescope. See page 20, January, 1929. The new telescope will enable scientists to see stars hitherto unknown and to plot new star clusters

FIGURE 1.

Left: Potato plant treated with solution of sodium thiocyanate, and *right:* Identical seed samples soaked for the same period in water

FIGURE 2.

Left: Normal growth of tubers of the "Irish Cobbler" variety, compared with samples (*right*) treated with ethylene chlorohydrin

Chemical Alarm Clocks Arouse Sleepy Plants

Tubers, Shrubs, and Flowers Begin Their Natural Activity Ahead of Nature's Schedule in Response to Chemical Accelerators

By A. E. BUCHANAN, JR.
Corresponding Editor, SCIENTIFIC AMERICAN

"BEAUTIFUL SPRING" has long been credited with a mysterious vital force which annually awakens dormant plants, inspires the sap to flow with fresh vigor, and clothes the drab winter world in a new dress of tender green. Leaving this phase of seasonal change to the poets, science has turned its searching scrutiny on "the flowers that bloom in the spring, tra la" to seek the *modus operandi* of spring's miracle and has found that certain chemical substances possess the remarkable property of awakening dormant plants and stimulating very appreciably their early development.

So effectively does the chemical alarm clock cut short the rest period prescribed by Nature that lilacs can be made to bloom at Christmas time,

FIGURE 3.

Left: Deutzia treated with vapors of chemicals. *Right:* Check plant, untreated

and potatoes, exposed to vapors of ethylene chlorohydrin, gain from two weeks to two months growth on the untreated tubers planted at the same time. The discovery is an eye-opener for potatoes, of course, but none the less for horticulturists and scientists, who see great possibilities in its commercial development, as in forcing the early blooming of certain potted plants which are favorites in the florist's trade.

CHEMISTRY has played an important rôle in the production of artificial fertilizers which supply plant food in readily assimilable form. This new application of chemicals to the initiation of growth, however, has no direct relationship to fertilizers, for the substances employed are apparently not utilized directly as food and produce results seemingly out of proportion to the energy they could furnish even if they were absorbed and oxidized. The how and why of this synthetic springtime is thus far limited to the general hypothesis that the chemical treatment induces some internal physiological condition which leads to the renewal of growth.

As far back as 1896, botanists have known that chemical treatment of certain dormant plants induces growth, but it is only recently that the phenomenon has been elevated, by intensive research, from the status of a scientific curiosity to that of a commercially practical process. Lemons, for example, are now quite generally subjected to ethylene gas to hasten the development of the desired yellow color.

Although the fruit is commercially mature when harvested, it may have considerable amounts of green color in the rind which is gradually replaced by yellow, if stored under favorable conditions. Concentrations of ethylene as low as one part to 1,000,000 parts of air hasten the coloration, although one part in 5000 is generally used commercially, in order to make up for loss of the gas by diffusion. While the mechanism of this phenomenon is not understood, it has been found that the presence of ethylene stimulates the life processes of the fruit, the rate of production of carbon dioxide from the respiration of the fruit being doubled and even tripled in 48 hours by exposure to air containing ethylene.

The latest and most spectacular results in this unique field have been achieved by Dr. F. E. Denny, botanist of the Boyce Thompson Institute for Plant Research, Inc., of Yonkers, New York. Approaching the study with the thoroughness and care of the true research worker and armed with a broad background in botany and chemistry, he has accomplished wonders in the artificial stimulation of growth, some of which are illustrated here.

FIGURE 4.

Left: Lilac grown with aid of accelerators *Right:* Normal growth without treatment

Potato growers know that good seed potatoes are those which have been stored for several months. Freshly harvested tubers germinate slowly and produce inferior stands, even if climatic conditions are favorable, because such tubers are in the "rest period." After

FIGURE 5.

Effect of treating a twig with chemicals and leaving an adjoining twig untreated

experimenting with 250 different chemicals, two substances were found which effectively curtail this period of dormancy—sodium thiocyanate and ethylene chlorohydrin.

Figure 1 shows the results produced by soaking the potatoes, previously cut in pieces for planting, in a 1 percent solution of sodium thiocyanate for 1 hour and planting the soaked pieces at once without rinsing. Two methods of

FIGURE 7

While its companions slumbered, this bud grew in response to exclusive treatment

treatment with ethylene chlorohydrin have proved successful—application in solution and as a gas.

In the first method, or "chlorohydrin dip," the cut pieces are dipped into a solution made by mixing 30 cubic centimeters of 40 percent ethylene chlorohydrin and 970 cubic centimeters of water; then storing them in closed containers for 24 hours and planting. Figure 2 shows results obtained by this method.

The vapor treatment may be used on the whole potato by placing the seed potatoes in slatted crates in a room that is approximately air-tight. From one quarter to one gallon of 40 percent ethylene chlorohydrin per 1000 cubic feet of space is evaporated into the room by means of an electric fan, and the potatoes are allowed to remain in contact with the vapors for 24 to 28 hours. Potatoes thus treated when removed from the gas room and allowed to stand in air at ordinary temperature will develop sprouts in 7 to 10 days.

As far as the cost of treatment by either method is concerned, this should not exceed five or ten cents per bushel of potatoes. Although sodium thiocyanate is poisonous, its handling involves no more danger than the handling of poisonous insecticides and if the treated tubers are protected from animals and the left over solution promptly disposed of, there should be no hazard in its use.

Another remarkable effect in the germination of potatoes is that of greatly increasing the number of sprouts per seed piece by soaking the pieces for one hour in a 2 percent solution of thiourea. This results in a larger number of *smaller* potatoes per hill, which is desirable in raising tubers for seed.

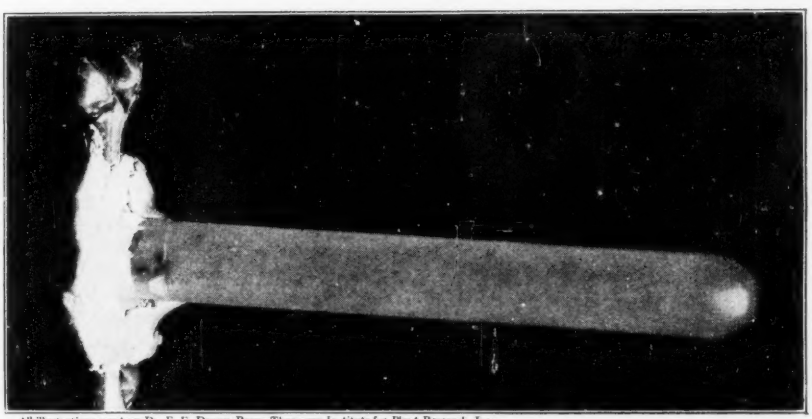
Ethylene chlorohydrin and ethylene dichloride have been found to "awaken" such woody plants as lilac, crab-apple, Deutzia, et cetera, from the rest period

FIGURE 6

Illustrating method of treating part of a plant without exposing an adjacent branch

that ordinarily postpones their flowering in hot-houses until February, so that they bloom before Christmas. The plants are placed for about 24 hours in a closed chamber in which a measured amount of the chemical is evaporated by means of an electric fan. About 10 cubic centimeters of 40 percent ethylene chlorohydrin solution per 100 liters of space give favorable results with most species, although some species respond to as little as 0.75 cubic centimeters. Ethylene dichloride in like amounts is equally effective. In the case of Deutzia, illustrated in Figure 3, strong concentrations of vapor cause the buds to develop more leaves but fewer flowers while low concentrations seem to produce flowers at the expense of leaves.

Figure 4 gives convincing evidence of the effectiveness of treating a lilac plant. Figures 5 to 8 clinch the demonstration by showing how a single twig or a single bud on a twig responds to the stimulating vapor.



All illustrations courtesy Dr. F. E. Denny, Boyce Thompson Institute for Plant Research, Inc.

FIGURE 8

By sealing the test-tube to the twig, only a single bud is exposed to the vapors during the treatment, enabling the scientist to gage accurately the effect produced by the fumes

All photographs by Ewing Galloway

SUGAR CANE WITH THE SWEETNESS GONE

Bagasse, the trade name for sugar stalks after the syrup has been extracted, formerly not only represented a huge economic waste, but there was the problem of disposing of it. Now converting it into wall board for buildings is one of the largest industries in Louisiana

A Use for Everything

Finding A Sale for Products Which Heretofore Have Cost Money to Dispose of, Is the Newest of Professions

By MILTON WRIGHT

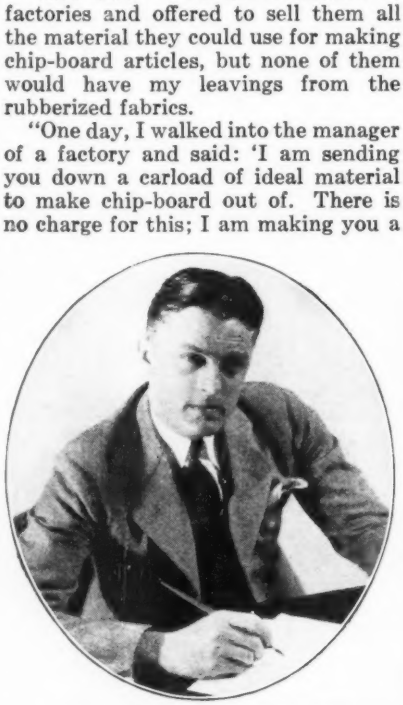
HERE is a man whose business it is to find a use for everything. In every industry there are chips, or dust, or scraps, or leavings of some kind which are thrown away. It is the business of this man to convert that waste into a useful product, to find a market for it where real money will be paid. The waste trade in this country is a billion dollar industry. It is constantly being added to by finding new uses and new markets for waste of all kinds and descriptions, a fact which has provided Theodore E. Koke, engineer, with an opportunity for a novel type of business.

We sought Mr. Koke and asked him to tell us how he happened to get into such a unique line of activity and to tell us some of the ingenious uses to which he has put material which heretofore has been destroyed or sold at prices far below its real value.

"I WAS with the United States Rubber Company several years ago and was put in charge of their salvage department in the Detroit plant," said Mr. Koke. "My job was to see that any waste products we had were sold. What was saleable seemed to be pretty well established, and the market and the price were pretty much standard.

"One of the things we were doing was to reclaim rubber from rubberized fabrics. We would take textile articles impregnated with rubber and remove the rubber with acid. The refuse of the textiles did not seem good for anything and we were flushing it into the river. I got to wondering if we could not find a use for it and at last it occurred to me that it ought to be good for chip-board. Chip-board is paperboard somewhat heavier than cardboard and is used for boxes and things of that sort. I visited a number of factories and offered to sell them all the material they could use for making chip-board articles, but none of them would have my leavings from the rubberized fabrics.

"One day, I walked into the manager of a factory and said: 'I am sending you down a carload of ideal material to make chip-board out of. There is no charge for this; I am making you a present of it. If you find that you can use it, we can talk business when you are ready for the next carload.' The result was that we received an order from that firm. None of that refuse has been wasted since."



"NO WASTE IS NECESSARY"

So says T. E. Koke, and he has made a life work of proving it to manufacturers

"But that is an extraordinary experience, isn't it?" we asked. "It was just a fortunate circumstance that the opportunity to dispose of a waste product happened to lie there; it was unusual."

"No, it wasn't. Here is another item.

"In every clincher type rubber tire, there is what is known as a bead. This is the little edge which fits on the rim. In making the bead, there is what is known as the bead overflow. This must be trimmed off before the bead goes into the tire. At the particular time of which I am speaking, rubber was worth about 28 cents a pound and it was cheaper to burn this bead overflow than it was to reclaim it for the rubber content. Obviously, there was not much we could do with the rubber, but it seemed to me that there might be some other ingredient which would be useful. I had a chemical analysis made and I found that these rubber strips contained about 30 percent of free zinc oxide.

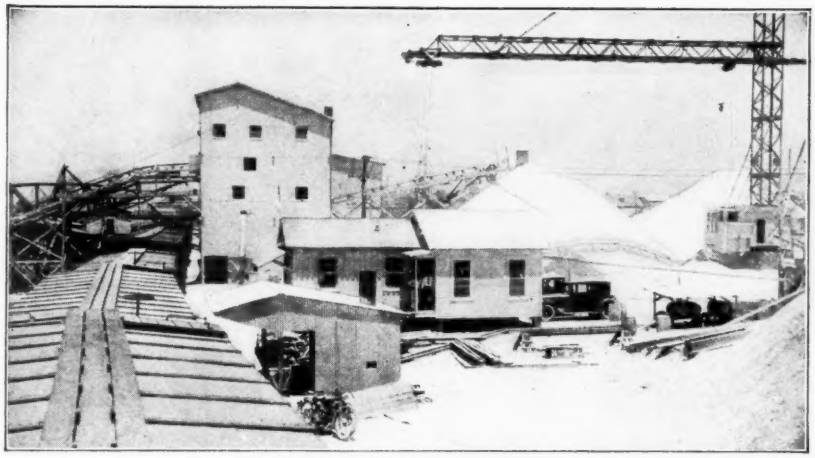
"THE job then was to find somebody that wanted zinc oxide. I finally located such a user in the Anaconda Copper Company's plant at Akron. They bought all I could supply them with, which amounted to more than 100,000 pounds a month.

"The next thing I took hold of was some short ends of tin-coated piano wire. Such wire was used as a wire bead in the straight-side type of automobile tires and the accumulated short pieces which were cut off amounted to a tremendous quantity. What to do with them was a problem. I finally managed to sell the entire surplus to the Vulcan Detinning Company of Pittsburgh. There was no reason why they should not reclaim tin from our wire as well as from old tin cans."

"Do you not find it rather difficult in some cases to find an outlet for a waste product?"

"Oh, it isn't easy. There wouldn't be any fun in it if it were. This thing of finding new uses for old wastes has become a sort of hobby with me. So many times have I been met with the objection 'It can't be done,' and so many times was I able to say 'I told you so,' that I adopted the slogan 'There is a use for everything.' I began to search out new uses for hitherto useless articles, not only because of the money involved but also for the pleasure I found in it.

"RUBBER was being received at our plant in 300-pound bales, each of them wrapped in a pouch of burlap. These burlap pouches were being sold at 12 dollars a ton to be used in the manufacture of roofing paper, which is about the cheapest paper made, for it contains almost anything and everything. The pouches or bags were almost new, I found. The shipment of rubber had been the only use to which they had been put and I wondered why they could not be used again without converting them into something else. I found out they would be admirably suited to shipping bales of cotton. Cotton shippers agreed with me, with the result that we sold the burlap pouches for seventy dollars a ton, delivering about thirty tons a month.



WEALTH IN OYSTER SHELLS

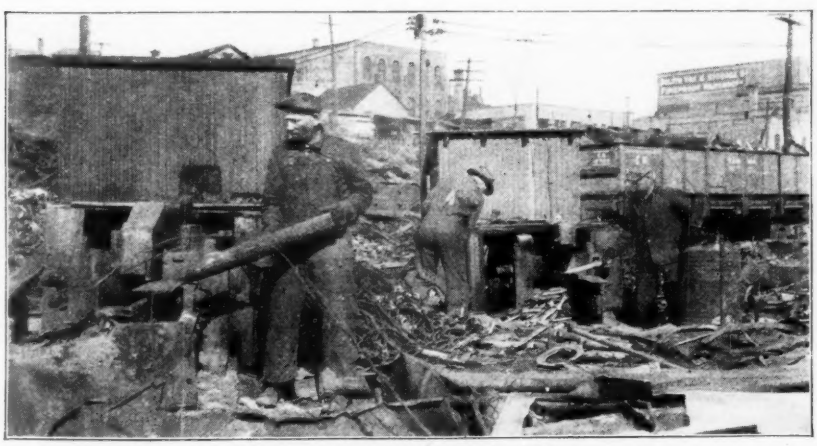
The value is not gone after the pearl, if any, has been extracted, the bivalve eaten and button disks cut out. What is left is crushed here for use in the building of highways

"Waste products are sometimes put to strange uses. I remember that it was quite a problem to dispose of the small size rubber tires. I made a survey of possible markets. At the Department of Commerce in Washington I learned that Spanish manufacturers were importing used tires of the smaller sizes, cutting them up into short lengths, putting a plug in each end and a strap across the middle and selling them to the Spanish peasants for sandals. They retailed at 33 cents a pair. I made a deal whereby we disposed of all our small-size tires to be used for this purpose.

"FOLLOWING this deal, the United States Rubber Company gave me a five-year contract and asked me to handle the salvage of the entire tire division which included the G. and J. Tire Company of Indianapolis, the Hartford Rubber Works at Hartford, and the Morgan and Wright factories at Detroit.

"With the making of some of the truck type of tires, a metal band was used. In reclaiming these tires, the rubber was taken off and the iron band was left. What could be done with it? I had this metal analyzed and found that it had a low phosphorous content. Such a metal would be in demand because it had a high re-melt value, and we could get a premium by selling it to companies making steel castings.

"In the Indianapolis plant, the inner tubes were wrapped with a strip of cloth, three or four inches wide, known as wrapping tape. By selling these to companies making roofing paper, we were receiving one cent a pound. I wondered if they could not be put to more valuable use. It occurred to me that possibly they could be used for making rag rugs, and I found a carpet company that could use this material. I sold them the discarded wrapping tape for seven cents a pound. Although there was only one carload a month, this was a jump of 1800 dollars."



LITTLE ONES FROM BIG ONES

Scrap metal is handled more easily when cut into small pieces. The worker places the iron on the bar and a heavy shearlike weight severs it as easily as thought it were a piece of paper

"THE secret of making money from salvaging, you would say, lies in finding a new use for your refuse?"

"Not necessarily. The value of waste material, I have learned, can be multiplied by proper segregation. In many plants it is the custom to throw all of the scrap metal into one pile. By segregating these scraps of metal and selling them separately, a tremendous increase can often be effected in the price received for the scrap.

"Waste paper is a problem everywhere. In some plants I was investigating, I found that much waste paper was being burned. The rest of it was being sold in bulk. Now, some kind of paper is worth one price and another kind is worth an entirely different price. By making inquiries of various manufacturers, who were using waste paper in the making of their products, I learned that I could get 40 dollars a ton for kraft paper, 12 dollars a ton for newsprint, and so on."

"But would it really pay you to do

SLAG FOR ROADBEDS

From the blast furnaces of western Pennsylvania the mineral smelting refuse is carried to Rusher, Pennsylvania, where it is prepared for use on highways and in filling railroad beds

that?" we interrupted at this point. "Is there not a labor cost involved which would outweigh the added price you would receive for your waste paper?"

"We always figured our labor cost before determining whether to make any change or not. Some people spend ten cents in order to reclaim a five-cent item. If the cost of reclamation is greater than the price received for the reclaimed object, naturally it is not worth reclaiming it.

"All sorts of things can be reclaimed. Take cinders, for example. In a Detroit plant, 15,000 cubic yards of cinders a year were being accumulated. For these the manufacturer was getting seven cents a cubic yard. I recalled that I had heard something somewhere about 'cincrete block,' a product in which cinders were mixed with concrete. There was a possibility of selling our cinders for this purpose, at 40 cents a cubic yard.

"THE problem was not completely solved even then, however. A further search for markets developed one in the realty subdivision field. By finding out the prices cinder contractors were getting, and by taking over the handling costs, it was found that a price of a dollar a cubic yard could be had and would yield a legitimate profit. A long term contract was entered into to protect the manufacturer from the difficulty of disposing of his cinders in the winter when the demand for them is not great."

"How do you get on the trail of particular waste products?" we inquired.

"It is the easiest thing in the world," he replied. "Everybody knows of something going to waste. You can not start a conversation on the subject without being informed of some new waste product that you had not heard of before. It is a delicate matter, however, to discuss with a man the waste there is in his own business. Nobody likes to admit that his own industry is producing any waste. That would seem to imply a lack of efficiency in operation. In discussing it with an industrial executive, you generally have to lead up gradually to it and let him discover for himself that possibly something can be done with all that refuse on the dump.

"HERE is an example of a waste product which is just about to find a new use. For more than a hundred years, a well-known company has had a waste product consisting of tough fiber. Recently it has amounted to about 1500 tons a year. It occurred to me that this waste fiber might make an ideal filler for certain commodities. If so, it could be provided in such quantities and at such prices that it would be widely used. I have sent a research man to work to ascertain if my hunch was a good one.

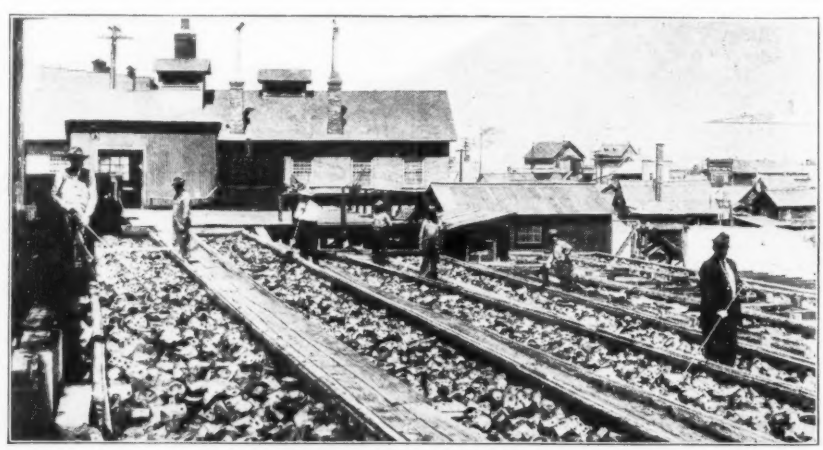
"Here is another. A large canning industry, I am told, has millions of gallons of fruit juice pumped into convenient creeks. How true this is, I do not know. When I get time I shall look into it. If the canneries are wasting any juice, I shall try to find a use for it.

"Recently I have been making a canvass of manufacturers, and the rapidity with which items of waste are reported is astonishing. One upon which I have just started to work is the disposal of 150 tons daily of a chemical being pumped into a meadow by a large manufacturing plant. There are at least five possible markets for this product which I expect to develop within a short time.

"THE useful products already converted from waste seems miraculous—automobile lacquer solvents from what was once a waste product of our mid-west cornfields, wall board from corn stalks, Rayon from sugar-cane stalks and a host of other things. It is a field, however, in which we have only scratched the surface. In time, reclamation of our waste products will become one of our biggest industries.

"I should say there is scarcely a manufacturer in the country who does not waste something. Sometimes the potentialities which lie in this waste mean the difference between showing a loss at the end of the year or showing a profit. One hundred percent efficiency is an ideal which few of us can attain but a lot of industries by a careful survey of their operations could approach far nearer to it than they do.

"We have wastes of many kinds—of idle machinery, of inefficient workmen, of cumbersome processes, of faulty cost accounting systems, and of a score of other things. There are men who specialize in each of these things. For my field I have chosen waste materials—refuse. That alone is a problem which will keep me busy the rest of my life and not myself alone, for I believe converting wastes into uses will become a highly specialized profession for many men."



MINING THE MINE WATER

At this Butte, Montana, mine, waste copper is reclaimed by using waste tin cans. Mine water is run into long tanks and the copper contained therein is precipitated by the tin

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WHEN MORE EFFICIENT LIFE-SAVING METHODS WERE NEEDED

A photograph of the *Vestris* as her passengers hastily donned life-belts and worked frantically to lower the boats as the ship listed prior to sinking off Virginia in November, 1928

We Offer a Medal for Safety at Sea

New Equipment Is Needed to Prevent Disasters and Loss of Life at Sea

THE tragic foundering far at sea of the steamer *Vestris* points to one thing above all others: the necessity for more efficient equipment for safeguarding ship passengers by preventing disasters and for saving their lives after some catastrophe has overtaken the ship on which they are traveling. From the mass of conflicting evidence that has been offered to explain the loss of the *Vestris*, many conclusions have been drawn but, whether or not any of these is anywhere near the truth, the fact remains that, had there been better devices for saving lives at sea, and had the ill-fated ship been fully equipped with them, it is possible that there would have been no loss of life.

With this in mind and in order to stimulate widespread interest in the vital problem of safety at sea, the editor of SCIENTIFIC AMERICAN has decided to award the SCIENTIFIC AMERICAN Gold Medal for 1929 to the inventor, designer, or manufacturer of the new device, devices, or apparatus which, in the opinion of the judges, will embody the greatest factor of safety for ships of any kind or type, exclusive of ships of war. An individual or company in any part of the world may enter for consideration any piece or pieces of such equipment developed between the date of this announcement and September 30, 1929.

The competition is without limitation as to race or nationality.

IN announcing this gold medal award, the editor is establishing a precedent in offering it exclusively for sea safety devices. While SCIENTIFIC AMERICAN has always been interested in promoting safety in every line of endeavor, never before has it felt that there was so urgent a need for safety in one specialized field. Of the eight gold medals that have been awarded for safety, however, two have gone to marine equipment companies. That these two were victorious in an unlimited competition, indicates the magnitude of the problem and the possibilities of improvement. Shipping is our oldest large industry and, because of the innumerable unknown factors entering into it, is still about the most dangerous with the exception of the fledgeling industry, aviation.

That the award of this gold medal for 1929 will be a peculiarly distinctive recognition, may be seen in the fact that none has been awarded since 1916. The device which merits it will, therefore, be an outstanding and noteworthy achievement.

The American Museum of Safety, 141 East 29th Street, New York City, has agreed to supervise the award of this medal. Between this Museum and SCIENTIFIC AMERICAN there has always been a fine spirit of co-operation in the promotion of safety. Due to our desire to make this announcement without delay, there was not sufficient time to complete certain details and announce them here. The Museum of Safety, however, will soon appoint the Board of Judges—most likely from among marine experts—and will arrange whatever further rules may be deemed necessary. These details will be announced in our next issue.

OUR 1913 GOLD MEDAL FOR SAFETY APPARATUS

This medal was awarded for the development of quadrant davits, a non-sinkable life-boat, a non-toppling block which does not fail after boat is lowered, and an indestructible rope

IN THE WILD-LIFE SANCTUARY

At the foot of the hill from which rises the "Singing Tower" with its beacon for birdmen is this beautiful lake, surrounded by tropical vegetation and constituting an ideal retreat for wild life. A group of flamingoes may be seen on the shore in the center background

A Beacon for Birdmen

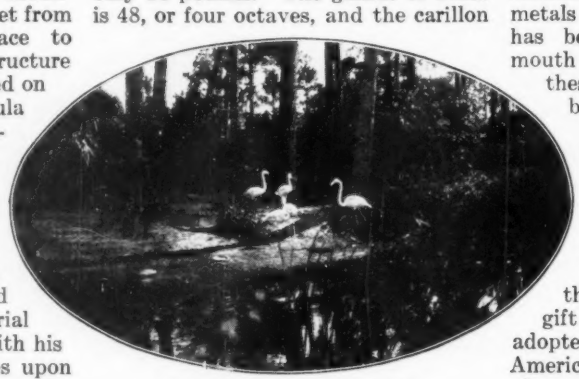
Lights to Guide Fliers Will Be Added to the Giant Bell Tower In Florida's Wild-Life Sanctuary

By L. B. ELLIS

ATOP one of the highest points in Florida, a bell tower of the Old World, carrying a powerful beacon for the aid of airmen, furnishes a curious mixture of old association and modern utility.

This magnificent campanile, or as popularly named "Singing Tower," just now completed, crowns the central Florida eminence known as Iron Mountain, rising to a height of 205 feet from its granite base. The menace to aviation from a massive stone structure of this type and altitude, erected on the highest point of the peninsula and carrying no beacon or warning signal, would be inconceivably great when, in the future, planes multiply and weave back and forth across the narrow strip of land. Consequently, E. W. Bok, who built and is donating to his adopted country this wonderful memorial edifice, has recently conferred with his architects and other authorities upon the matter, and now sanctions the announcement that the tower will carry a beacon to guard the airways.

The campanile is at Mountain Lake in the heart of the state's scenic highlands on the central ridge of the peninsula. One of the largest carillons of the world has just been installed in the tower—61 bells with an aggregate weight of 123,164 pounds. The big tenor bell weighs over eleven tons, and the silver-voiced baby of the lot only 16 pounds. The gamut of tones is 48, or four octaves, and the carillon is thought to surpass in power as well as fineness any other set of chimes now existent.



A SEQUESTERED NOOK

Another corner of the bird sanctuary, and another group of flamingoes at home

The bells were cast in England, at the famous old foundry of John Taylor and Company, Loughborough, where they have been casting world-famous chimes and carillons since the 14th Century. They claim that the formula for the composition of the metals and the tuning of the bells has been transmitted by word of mouth from sire to son through all these centuries, it never having been entrusted to writing.

The massive units have now been swung upward, some at an altitude of 140 feet, others 180 to 190. The dedication of the carillon and tower, together with the Mountain Lake bird sanctuary, will take place the first of February. They are a gift of beauty and worth from an adopted son to the great mother, America, who has given him success of no ordinary kind.

"Bok's Bells" the native Floridians call the carillon; and "Singing Tower"

it is. The gentle-faced, elderly man who came over here a friendless immigrant lad smiles approvingly at both names.

"The tower would be *klokkenspel* back there in the Netherlands," he says, "for the great campaniles of the world, made, some of them, as the noblest architectural creations, have evolved from the old-world watch towers, carrying their big, clanging bells to peal forth a harsh alarm whenever the sentinels might espy from their battlemented tops either an invading foe, a broken dike or devastating fire. In this happier time and land, we have kept the tower idea, developing it into a 'singing tower,' its bells evolving into tunefulness—the whole creation a thing of beauty."

From time to time, one or another of the native folk, as he moves among the on-lookers around the splendid structure, will ask him, "You built all this just for your own pleasure, didn't you, Mr. Bok, because you have a winter home here, and want something different when you come down?"

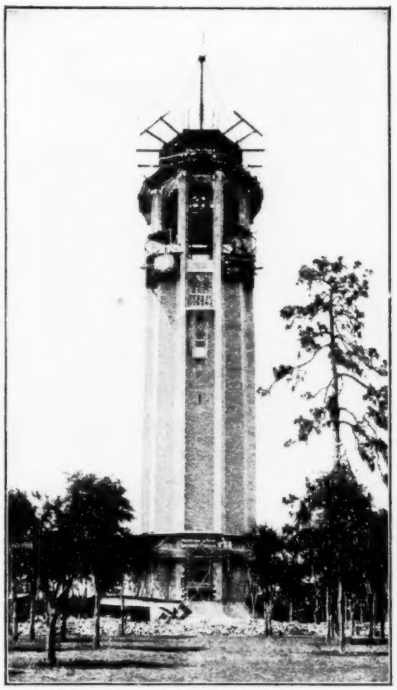
"BUT how little point," he answers, "to build a great beautiful structure like this, housing therein all that tuneful mass of metal, cast into wondrous shapes and gradations, all for the pleasure of one person!" If this seems to reach the listener with due force, he may proceed to expound his theory that this is an investment in beauty, because beauty is truth and both uplift the spirit. He hopes that in erecting the tower, placing in it the marvelous carillon and encircling them with the charming park and bird sanctuary, he has done something for future generations as well as the present, something that tends profoundly towards spiritual and esthetic gain for many people.

The tower is modeled on the lines of the campanile at Malines, thus continuing, in a way, the old-world tradition. But the dominant motif, in decorations, carving, and materials, is American; in fact, almost wholly Floridian. For structural strength the steel frame-work, anchored to a reinforced concrete mat, is said to be unsurpassed. The exterior is of pink marble from Georgia, and of picturesque Florida ocquina, making a harmonious whole that is the admiration of all who see it. Soaring upward more than two hundred feet from its granite base of 51 feet in width, with gradually changing form and tapering lines, the structure becomes octagonal towards the top, and little more than 30 feet in width.

THE Florida motif is especially noted in the grille of faience adorning the great lancet windows through which the melodious bell-notes are to travel outward. Here the development of life is suggested, from the undersea forms on through the flora and fauna of the state.

The carvings on the marble band encircling the tower, and on the pinnacles, replacing the usual ancient Gothic gargoyles, are of eagles, herons, flamingoes, and pelicans. One might easily suppose that Lee Lawrie, the sculptor in charge, had stalked the lake and woodland habitants of the sanctuary for his models.

An effect more pleasing can scarcely be conceived—a structure of such architectural charm, lifting to such height, under the turquoise skies of a summer land, with a landscape spread below, of orange groves, shining lakes, and splendid native forest growth of live-oak, magnolia, pine, and palm. Then to the natural beauty of the park, some fine landscaping has been added by Frederick Law Olnsted, Mr. Bok insisting, however, only on the enhancement which stops short of artificiality.



THE TOWER,

Constructional work on the shaft. See also frontispiece of this issue, page 104

In the park a few English nightingales are being Americanized at present, perhaps to listen in wonderment to the English chimes, when Anton Brees, the carillonneur, has come over to play them, as he is soon to do, being engaged as maestro at the Singing Tower.

Toward the ocean and the Gulf the music will be carried on the tropical breezes. The tower on Iron Mountain is 67 miles, as the crow flies, from the Atlantic, and a trifle over 70 to the nearest inlet of the Gulf of Mexico.

ENTRANCE TO THE BIRD SANCTUARY

This gateway is located at the Mt. Lake entrance to the area within which is situated the "Singing Tower." Photograph was taken when only the skeleton frame of the campanile was finished. Note it on the rise of ground (highest point in Florida) at the extreme right

The Month In Medical Science

A Review and Commentary on Progress in the Medical and Surgical Fields

By MORRIS FISHBEIN, M. D.
Editor of the Journal of the American Medical Association *and of* Hygeia

The Deafened School Child

TWO years ago more than 1000 children in a New York school were tested by a modern method involving the use of an electrical apparatus to determine the percentage of loss of hearing among them. The method used involves an apparatus called an audiometer, which makes it possible to test 40 children at one time. Out of the approximate 1000 children tested in the two periods, about 80 percent were found to have normal hearing and from 5 to 8 percent were found to be deafened.

Re-testing indicated that about one third of all children selected by such methods as being deafened are found to be borderline cases. Moreover, the test shows that there are large numbers of children who are in this group whose hearing may be greatly improved with proper attention. Hence the investigators suggest that children in schools where some thousands of children are given routine tests be re-examined at fairly frequent intervals so as to prevent any child from being overlooked and not given the opportunity for recovery that comes with proper diagnosis.

Annual examinations of the hearing should be made, and special attention given not only to all children found to be deafened at the time of any single examination but also to all children who have at any time suffered infections of the ears. The evidence indicates that there are at least 3,000,000 deafened children in the United States.

Children between the ages of 15 and 18 years of age who have recurrent attacks of deafness three or four times a year and who recover from such attacks following proper attention to the nose and throat should have constant attention until the nose and throat conditions are cleared up. If not, they may inevitably look forward to a life of complete deafness in adult years.

Noise and the Public Health

IN a special report submitted to the Minister of Health of Great Britain, the British Medical Association has qualified all sorts of noises. An unnecessary noise and a public nuisance is any noise made at times of the day or night when it is most likely to be disturbing; any noise that is loud, screeching, strident, or discordant, and any noise that is discontinuous and unrhythmic.

A healthy person is capable of adapting himself to all sorts of peculiar conditions, but every adaptation causes a certain amount of wear on the nervous system. Investigators have found a definite relationship of unnecessary noises to loss of personal and industrial efficiency. Most noises occurring in industry are rhythmical, uniform and continuous; they do not involve sudden changes of quality, pitch, or intensity, nor occur so suddenly as to startle the hearer. Street noises are entirely different than noises taking place in industry. The sudden unexpected screech of a motor horn, the rattle of a wagon loaded with milk cans, or the explosion of a motorcycle exhaust is bound to irritate the nervous system.

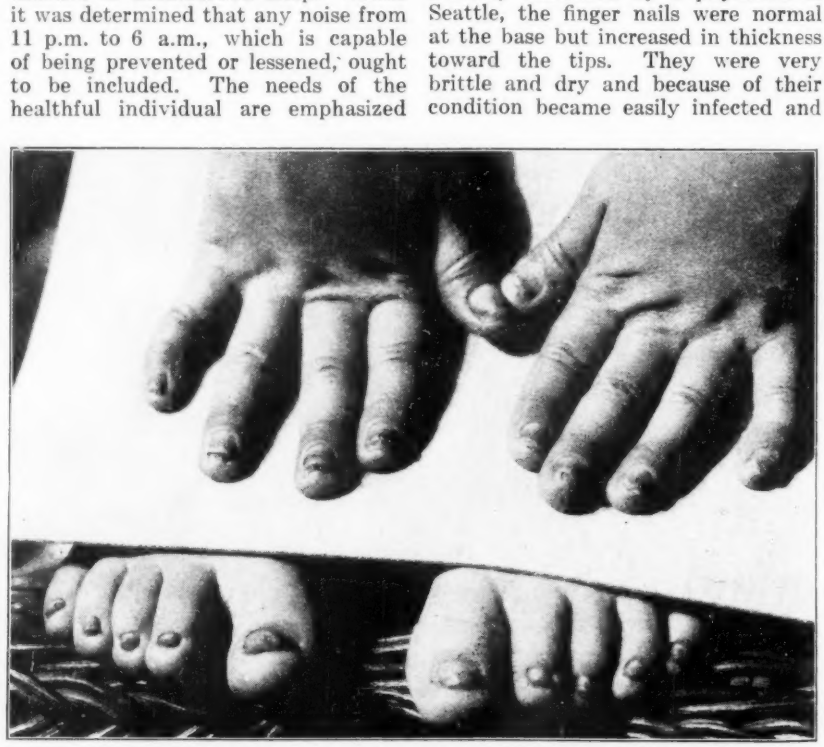
The ordinary citizen needs a certain amount of undisturbed sleep. Hence it was determined that any noise from 11 p.m. to 6 a.m., which is capable of being prevented or lessened, ought to be included. The needs of the healthful individual are emphasized in the case of sickness. People who are nervous or who suffer from insomnia may be driven almost to the point of distraction by irritating and useless noises at night. In its consideration of the subject, the British Medical Association classified among preventable noises the following:

(1) Inefficiently silenced motor vehicles.
(2) Warning instruments carried on motor vehicles; particularly strident horns and electric hooters.
(3) Barking dogs.
(4) Cries and bells of street vendors.
(5) Careless handling of milk cans.
(6) Noises on railways.

It suggests control by law of some of these noises and education of the public in the control of noise.

Inherited Changes in the Finger Nails

CERTAIN diseases affecting the finger nails and the hair seem to occur regularly in families. In a case recently described by a physician of Seattle, the finger nails were normal at the base but increased in thickness toward the tips. They were very brittle and dry and because of their condition became easily infected and



INHERITED CHANGES IN FINGER AND TOE NAILS

This example of dry, brittle nails occurred in the fourth generation. Treatment was found to be without effect, the annoying condition being established as hereditary in character

fell off. The heredity of the child was traced. It was found that one great-grandparent was affected. Of this family, 13 children were born, of whom six had the disease. In the next generation there were 26 children of whom five had the disease, and in the next generation 25 children of whom four had the disease. Thus 16 out of 65 in four generations were afflicted, 11 of them boys and five girls.

Treatment was without effect, since the condition seemed to be definitely related to some hereditary disturbance.

Paralysis of the Kaiser's Arm

AN investigation of the available literature indicates two possible theories as to how the arm of Wilhelm Hohenzollern, the last of the kaisers, became paralyzed. One story has it that the birth of the child was difficult and that he suffered with what physicians call an obstetrical paralysis. According to that report the child hovered between life and death for more than an hour and a half before the pendulum swung definitely toward life. On the third day it was discovered that the left arm was paralyzed, the shoulder socket torn away and the surrounding tissues severely injured. No doctor would venture surgical operation for repair.

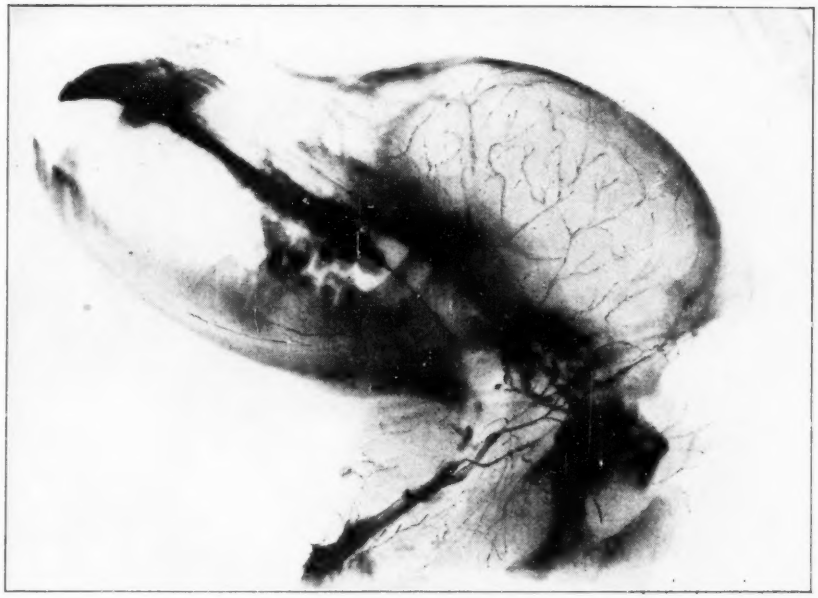
The second story has it that the mother, the Crown Princess Frederick, took the child with her on horseback when he was two years of age and dropped him. After about three weeks it was discovered that the arm had become paralyzed.

The evidence is not clear in either case, but the first story seems more probable.

Changes in the Blood After Ultra-Violet Ray Treatment

MANY of the claims made as to the value of ultra-violet rays when applied to the human body have to do with effects that would be secondary to improvement of the general quality of the blood, so far as relates to the number of red and white blood cells. It is already well established that exposure of the body to ultra-violet rays does profoundly affect the system and it is necessary therefore to have a complete understanding of these effects before physicians will be able to determine the proper dosages under various circumstances.

Some investigators have shown already that the exposure of dogs to the rays of the carbon arc is followed sometimes by an increase in the number of red blood-cells and sometimes by a decrease, but with a tendency toward increase rather than decrease. Apparently the rays stimulate the bone marrow and other blood-forming organs to form new red blood-cells.



SHOWING THE CIRCULATION OF BLOOD

After injecting into blood vessels five cubic centimeters of iodized rape-seed oil, diluted four to one with ethyl olive oil, X-ray photographs will show the blood circulation, as above

Two other investigators have shown recently that following exposure of animals to the ultra-violet rays, there is also an increase in the fluid matter of the blood which disappears after a few hours. Repeated exposure to the rays stimulates the blood-forming organs to produce an increased number of red blood-cells which persist for several weeks after the last raying. However, the newly formed red blood-cells are usually smaller than the ordinary red blood-cells, and associated with this there is sometimes apparently a lessened number of white blood-cells. Massive doses of the rays are apparently capable of destroying red blood-cells.

This evidence indicates the need for extensive study and careful investigation of the effects of the rays before people begin to use them without careful supervision. Every potent force in medicine is a two-edged sword capable of doing harm under wrong conditions, as well as good under proper conditions.

Visualizing the Spine

IN 1923 two French professors reported that the injection of poppy-seed oil into the spinal canal would enable visualization by use of the X ray. Recently American observers have given special attention to the use of other substances. Drs. Frazier and Glaser have found that rape-seed oil when iodized is preferable to the poppy-seed oil because of its low toxicity and non-irritating properties. If it is prepared with sufficiently low viscosity, it will flow easily through a fine needle and distribute itself thoroughly in the spinal canal.

It was also desirable to find some substance which could be put into the blood vessels so as to permit visualization of the blood vessels in the brain, a procedure of great importance in the diagnosis of certain brain diseases. Such a preparation was worked out and tested experimentally on animals. Apparently it was possible to inject small amounts of this substance into the blood vessels without any ill effects to the animal. As shown in the illustration, it is possible to visualize the circulation of the blood in the brain and to obtain an outline of the brain structure.

Airplanes to Control Mosquitos

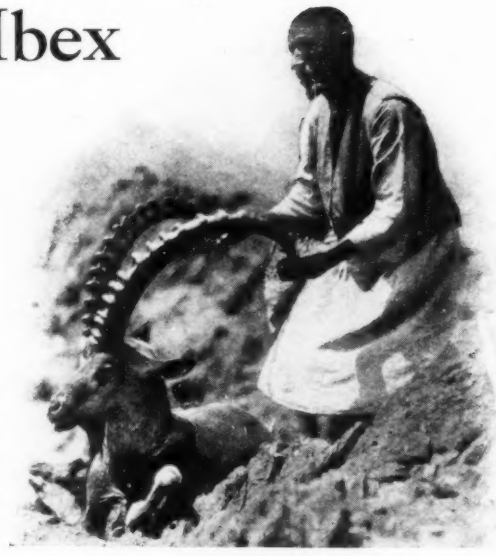
THE attempt to rid marshy areas of pestiferous anopheles is a problem that has constantly disturbed the public health worker. Drs. S. S. Cooke and L. L. Williams, Jr., of Virginia, have developed a method involving the use of the airplane, which they insist is commercially feasible. A mixture of 33 percent of Paris green in an inert dust is taken up in the airplane and sprinkled over the involved areas, one pound of Paris green per acre being considered a proper unit.

At Quantico they sprinkled the infested areas in periods varying from six to 13 days. It was found that Paris green-soapstone mixtures, when distributed by airplanes, will penetrate all forms of vegetation indigenous to the Atlantic seaboard. The dust is put into a simple box with sloping sides which may be opened when distribution is begun. One airplane can cover 20 square miles of breeding surface, and the material costs approximately 70 cents per acre, per season.

With "Fuzzies" After Ibex

Scientists Turn Big-game Hunters as They Pursue the Elusive Ibex In the Red Sea Hills of Sudan

By H. E. ANTHONY
Curator, Department of Mammals, American Museum of Natural History



A NUBIAN IBEX

One of the animals bagged above the Khor Sharag by the expedition described in the text herewith

WHEN Irving K. Taylor, who had made three trips into the Anglo-Egyptian Sudan, decided upon a fourth visit, he planned for something more than the usual sportsman's jaunt and offered to finance and conduct an expedition for the American Museum of Natural History of New York City. It was a splendid opportunity for the Museum to secure much needed specimens of the fauna of the Sudan. The region of the upper Nile was very poorly represented in the American Museum, and valuable results were certain to follow an acceptance of Mr. Taylor's offer. It was my good fortune to be sent with Mr. Taylor as the Museum representative and naturalist and to be his companion on a trip which lasted from December, 1926, into June, 1927, and took us over nearly 4000 miles of the Sudan.

Of the many interesting experiences which came our way none impressed me more than our hunt for the Nubian ibex in the Red Sea Hills. We had spent the first three months of our time from Khartoum southward on the White Nile collecting many specimens of mammals, birds, and fishes. There were many high-lights which stood out from the everyday routine, such as a close call from a charging buffalo, our success in getting good photographs of the whale-headed stork, and the capture of one of the huge Nile perch. But our experiences with the natives of the Red Sea Provinces, the "Fuzzies," will always be one of the choicest recollections of my first African expedition.

TO reach the ibex country we went by train from Khartoum to Port Sudan and then by a short spur line to Suakin. A Ford car and motor lorries brought us and our outfit to Tokar where our camel caravan, or *hamla*, was assembled. Tokar is the center of a rich cotton district, and during our brief visit an annual agricultural show gave us a chance for some unusual pictures. When we left Tokar we struck across a bare and inhospitable desert and on the third day reached the first of the Red Sea Hills. Several days more were required to arrive at the camp site which our head guide had designated for us and then the hunt for ibex was on in earnest.

A blazing sun had slowly crossed a sky of brass, and shadows were lengthening behind the rocky, heat-shimmering ridges when our two guides came up to the tent where we sat cooling off after our four o'clock tea, brought their heels together, and saluted in military fashion. Osman, our official interpreter, was lying on his back in the cook tent, his leg swollen from the bite of some venomous creature, a scorpion perhaps, or possibly a snake, but we hoped for his sake it was not the latter. The night before, he had stepped on some unknown thing in the dark and now was beginning a two weeks' period of helplessness.

WE soon learned, by mixed Arabic and English, that our guides knew where we could expect to see some ibex. Our auxiliary forces, the "Fuzzies," had scouted over the hills and reported favorably. We would get up at three o'clock in the morning, the guides said. This aroused no wild enthusiasm, but if it was part of the game we would do it. After a few questions, the conference came to an end and the guides went back to the native section of camp.

It seemed as though three o'clock came as soon as we had fallen asleep, and if the ibex chose such an hour to be on the move we understood why so few sportsmen go after them. About four o'clock we filed up the sandy floor of the Khor Mashail, the cañon where we camped, and a mile or so above entered a tributary *khor* (stream-bed or ravine) and headed for the *jebels* (hills) above the Khor Shalalta. We took station with the two guides on a

All photographs courtesy Taylor Sudan Expedition, Amer. Mus. Nat. History

KHORS AND JEBELS

This view of the country through which the author hunted gives an excellent idea of the habitat of the Nubian ibex. The difficulties encountered are readily imagined

promontory which commanded a vast enclosed amphitheatre and the sun had not yet appeared as we selected places where we would be hidden against the rock.

THERE are two ways to hunt ibex in the Red Sea Hills, neither one of which is easy on the hunter. One is to climb the ridges and stalk the animals where you find them; the other is to climb up where ibex are likely to pass and then send native beaters out to drive these wild goats past the points where the guns are stationed. While the latter method may sound like a tame procedure, this is by no means the case, for the ibex are wary and it is no small achievement to kill a "billy" even if it has been driven down from some more remote fastness.

For beaters we employed the native inhabitants of the hills, the Hadendoa or Beni Amer, the "Fuzzy Wuzzy" of Kipling's poem. The "Fuzzy" is a splendid, picturesque type of Hamitic stock, with a huge head of hair which he dresses with grease, so that he greets the nostrils at about the same range as a flock of his own sheep. He is a mountain climber *par excellence* and about the only human being who can dislodge and press after a stubborn ibex. We had nine "Fuzzies" to beat the sky-line ridges and eight camel drivers to take up posts on the lower divides and turn the quarry in toward the hunters. Several hours are required to surround an area and get the ibex started for a given post, and on the morning in question we saw and heard nothing until the sun was above the horizon.

A faint tinkle of sliding rock at last drew our attention to the slopes of the rocky hill to the northeast. Three gray-brown animals swept around the brow of the jebel and, after a short run, stopped and watched the eastern sky-line. With our glasses we could see that they were ibex, but they were so far off that we could not judge the size of their horns. Furthermore, the light was still poor, for the sun was low, and there were great patches of dense shadow where the hollows lay under the peaks. Presently a "Fuzzy" topped the crest, following the track of the band, and then other "Fuzzies" bobbed up along the encircling ridges. The drive seemed well in hand.

"FUZZY"

SHOUTING to one another, the beaters pressed after the ibex, which lost little time in seeking escape in the only direction left open to them. The animals tracked along in single file and with a marvelous sure-footedness, seeming literally to pour themselves across the steep slope into a shadow-filled ravine, at no time coming nearer than 500 to 600 yards from our stand. The beaters circled rapidly, cutting off escape on the far side of the rocks where the ibex had gone, and then tried to turn the animals in our direction.

On the still air of the dawn sounds carried far, and the noise of the small, dislodged stones was audible for half a mile, while one must needs have been deaf not to have heard the shouts of the "Fuzzies" and the avalanches of rock which they sent cannonading down the mountain-side to stampede the suspicious quarry. The ibex did not want to be driven, and when they could not break through on the side they desired, they became stubborn and refused to move at all. On a later occasion I watched an ibex through my binoculars (the animal being unaware of my presence) when it was not in the mood to drive, and saw it go into a hole under a large rock, where it calmly remained, ignoring tumult and loose rock, until the men themselves were almost up to it.

This particular morning the beaters shouted to one another and converged upon the Jebel Shalalta with all their forces. "Fuzzies" hurrying up from the rocky ridges to the west drove out two hyenas before them. These big, dog-like carnivores trotted silently down a ravine and lost themselves in the gloomy depths of the Khor Mashail. I was glad of this glimpse of them, for on our first night in the khor we had heard the cavernous howl of a hyena reverberating up the valley, an ominous sound suggestive of great power—sonorous and sinister.

THE "Fuzzies" shouted "Ao, ao, ao," their name for the ibex, and ran along the rugged crests in sure-footed abandon. One native in particular had a great full-throated bass and when he poised on some precipitous crag, peering into the long shadows below, his bushy hair giving him the appearance of some unnatural being, I thought to myself, "What a setting for the Peer Gynt Suite." When his rollicking "Ho, ho, ho, ho" rolled in great waves of sound through the rocky defiles, then indeed he became a gnome in the "Hall of the Mountain King."

The three animals we had first seen soon returned across the *talus* opposite us, but now we had little attention for them, for we could see in the better light that they were females or young males—not a good head in the lot. The natives were calling that a big "billy" was still lurking in the shadows and that we were to keep an eye open for his appearance. After thirty minutes of pandemonium, when shouts and crashing rocks aroused nothing more substantial than echoes, the "Fuzzies" walked into the deepest recesses and drove the ibex out into view. He was a splendid animal with great sweeping horns. Too far for a shot, he made a rather leisurely exit across the slope just below the crown of the *jebel*,

FROM THE WATERS OF A SUDAN LAKE

Ibex are not the only lure for the sportsman in the Sudan. The author's party succeeded in capturing this remarkable specimen of the huge Nile perch. It weighed 45 pounds

WHALE-HEADED STORK

This queer-looking bird was encountered and photographed on the Bahr-el-Arab

stopping frequently to look back at the vociferous beaters and disregarding the rock dislodged from above in the hope of turning him down into the floor of the ravine.

The ibex understood falling rock, and neither the demoralizing din of its fall nor the actual striking of missiles near him caused him to hurry. He went just where he wanted to go, broke through the cordon at the spot where ibex had first entered the picture, and left the Jebel Shalalta. Our morning's hunt had bagged for us only experience, but that alone would be worth the effort it cost, and the ibex had certainly deserved his escape by his refusal to be "rattled."

WE soon learned that we could discount the native zeal for early rising. When our head guide, Mohammed Ali (called "Ali Kebir," "the big Ali," to distinguish him from other Alis in camp) said three o'clock, we said four and stuck to it. Upon one such morning the moon saw us mount our groaning camels and pad noiselessly down the *khor* for the Jebel Gadem, an hour or more to the west. Upon this occasion we took up separate posts, and in due course of time a good male was started. The regular program followed, a noisy convergence upon the spot where the "billy" insisted upon hiding, the failure of crashing rock to demoralize the animal, and the eventual rout of the ibex by a native who walked into its hiding place. This time I could see the final routing of the beast; the "Fuzzy" was only a short stone's throw from the ibex before the animal admitted defeat by running away.

The "billy" successfully avoided me, whom he had doubtless located early in the game, but tried to cross from one ridge to another and dropped down into the ravine between the two. This brought him past the post where Mr. Taylor waited.

In less time than it takes to tell, the ibex crossed the *khor* and appeared at the foot of the long climb on the other side. As the animal came up on a great rock and stood poised for an instant, the ravine roared from the shock of Taylor's rifle and a white spurt of rock dust puffed at the feet of the ibex. This did not alarm him any more than the rolling rock had done, and he began to climb deliberately for the sky. An ibex is not a large mark and at moderate ranges is missed surprisingly often. Puffs of dust marked the path of the ibex until, just as it was about to pass over the first low ridge and into safety, a bullet from Taylor's rifle found its mark and the hunt was over.

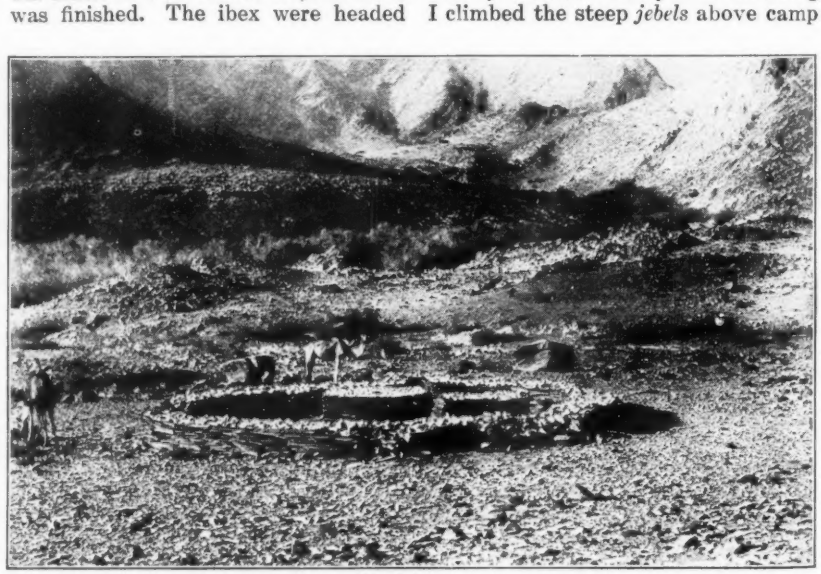
The ibex pitched clear of the rock where it stood and, striking only two or three times, fell almost sheer for a hundred yards. Strange to say, this fall did not hurt the beautiful sweeping horns, although it did rub some hair off the body. The horns measured 21½ inches, and although not as large as those of males killed later, gave us the greatest thrill of the trip because they were the first.

THE fortune of the chase favored Mr. Taylor, and to his rifle fell the next ibex secured, the largest head we took, measuring 38 inches along the horns. This "billy" was secured as the culminating event of a very long drive. Before daybreak we had departed from camp at Adelaueb and taken up separate stands on the Jebel Shalalta. The drive sent ibex part way along the rugged shoulders of the peak, but the animals turned back too soon and broke through the beaters before they could close up their widely extended line.

The entire morning was spent in the effort to get the band, which contained two good males, back on the Jebel Shalalta, but finally word was hallooed from the west that, as far as our stations were concerned, the hunt was finished. The ibex were headed for the Khor Mashail; if they attempted to cross that, we might get a shot later. We returned to camp and had lunch, while at intervals faint shouts in the distance told us that the "Fuzzies" were sticking like hounds to the scent and were still in touch with the ibex. Early in the afternoon the shouting took up the sustained reiteration of the short word the natives all used when the action became thick, and our guides hustled us out of the shade (thermometer over 100 degrees there) and down the Khor Mashail. Soon we separated and climbed up to posts which commanded the two ravines where the ibex were coming.

THE sun was pitiless and there was no shade. Slowly I fried on a big slab of rock and hoped that something would happen soon so that we could get back to the tent and shelter from the sun. The drive pelted into the ravines and then I could tell that the commotion was all passing down the one where Mr. Taylor was posted. Three or four ibex, females, appeared against the sky on a little peak that limited my northern horizon. They were slipping away from the beaters and waited just behind the peak, looking back the way they had come. A burst of firing in the next cañon roused the echoes; then comparative quiet reigned. The shouting ceased, and the ibex in my vision returned to the rocky slopes whence the drive had routed them. Mr. Taylor had secured a good "billy" and, incidentally, filled his license allotment.

Male ibex with good horns seemed to be so scarce about the Khor Mashail that we moved camp over to the Khor Sharag to permit me a better selection for the remaining ibex I was allowed on my license. Early next morning I climbed the steep *jebels* above camp



NATIVE CEMETERY IN SUDAN

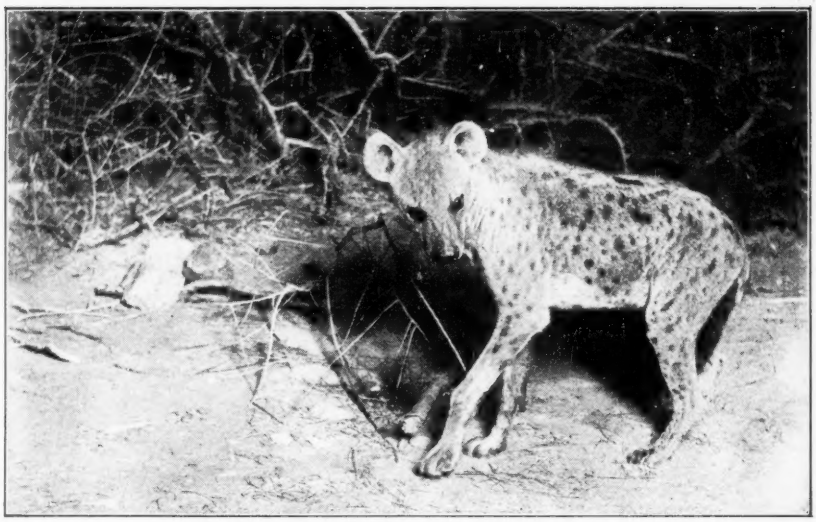
This illustration also serves to show the reader the character of the country in Sudan. Note the level plain, the scrubby vegetation, and the bare hills rising in the background

and found a station which gave me a broad outlook over a wide expanse of rough and broken country. The "Fuzzies" scattered to the four quarters of the compass and Mohammed Ali and I settled back to wait for the drive. The first rays of the sun were welcome, for the wind was cool up there and I was content to bask a while in their warmth and to enjoy the early morning.

The rocks were beginning to take on heat, when movement along a distant skyline caught my eye. The binoculars disclosed a fine male ibex. This "billy" was taking no chances and remained high—a characteristic ibex trait—to seek the highest spot on the horizon and play hide-and-seek about it. He shortly dropped out of sight and another long wait followed.

OUT of the northern sky, right where I had seen the ibex and where I knew my beaters were focusing their attention, a band of domestic goats dropped over a ridge and began to work down toward the wells in the *khor* below. A "Fuzzy" shepherd drove the flock and marshalled them in good order by shouts and grunts. He and his goats were silhouetted on a crest half a mile away but I could hear the click of each hoof against the rocks and the peculiar goat-like snort that the "Fuzzy" made from time to time. These natives have the faculty of emitting a resounding snort which is unlike any human vocal effort I have ever heard, and apparently it means something in the goat vernacular, for the beasts follow a snorting "Fuzzy" better than they would be driven by a shepherd dog.

In spite of this disturbance, the drive came to a successful conclusion. In due course of time, three ibex, all "billies," popped up against the horizon—what a picture a male ibex makes with his superb horns clear-cut against the sky—and ran down in the very tracks made by the domestic goats. The ibex circled and were headed by shouting beaters. The ring of excited "Fuzzies" drew tighter and tighter as the natives hurried up to the rallying call. A chant of "Ao, ao, ao" and "Ho, ho, ho, ho," punctuated by the crashing din of falling rock, brought us all to a fine pitch of excitement.



A SPOTTED HYENA

By means of a cleverly designed setup of camera and flashlight apparatus, this excellent action photograph of a spotted hyena was secured during one of the cool Sudan nights

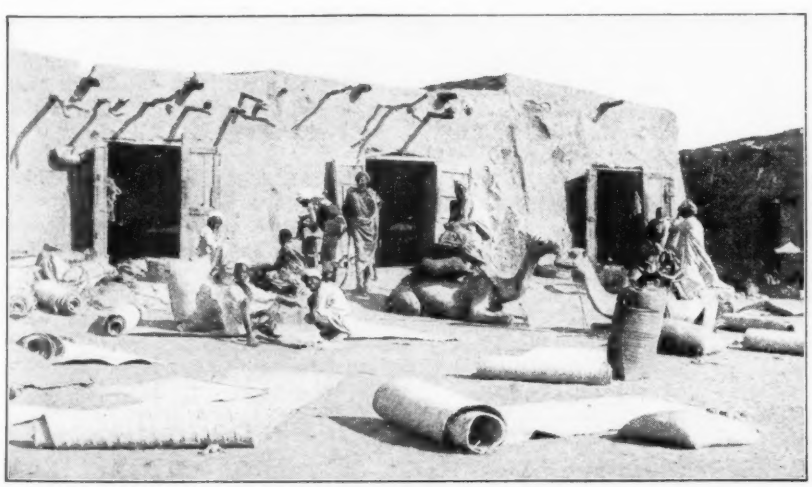
IT was apparent that the beaters had the ibex about where they wanted them, but were having difficulty, as usual, in the final push to send the animals down our side. Ali and I peered around our little peak first on one side, then on the other, but we could see nothing. When we could stand the suspense no longer, the old guide indicated to me that we had best climb to the next peak, a few yards higher up, and look into the basin which it masked from us.

We slipped out from our concealment and hurried up to the next spur. A few minutes of peek-a-boo about the rocks, and Ali grasped my arm excitedly to draw me still farther out from shelter. Leaning out over the crag, I found myself eye to eye with a bearded patriarch of the flock, a scant one hundred yards away. The ibex had been slinking off among the rocks and making such good use of the terrain that they almost escaped.

YOUNG IBEX

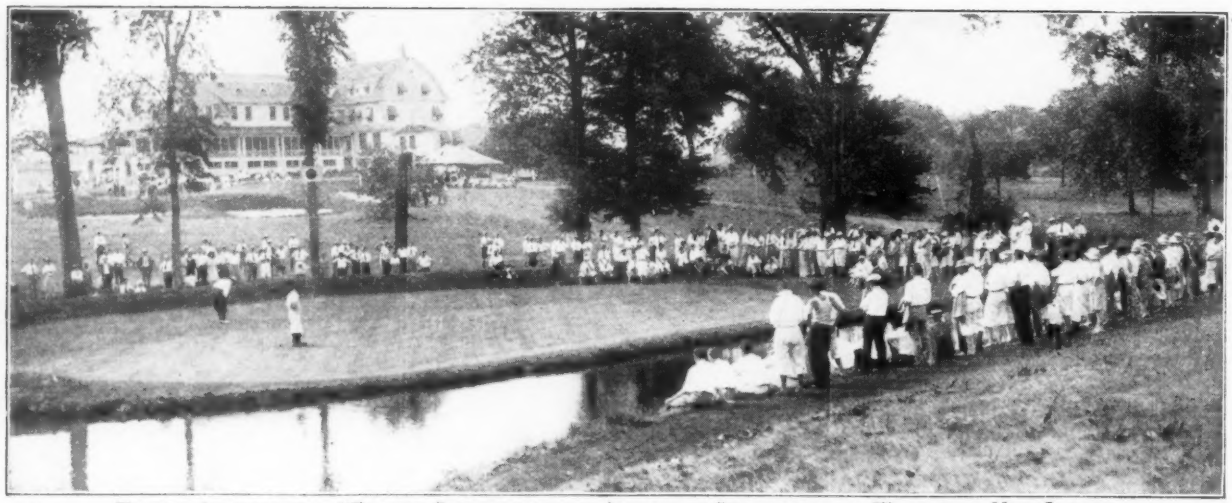
This tiny animal was captured and led around on a leash by one of the natives

The "billy" fell in his tracks, lodging in the rocks, which kept him from a long fall. At the shot, another splendid male ibex leaped into view, calmly took in the situation, and bounded down the hill. He was followed by a third male, equally large. I had my needed specimen and did not molest the others, but watched with admiring eyes that swift, sure flight over a slope so steep and precipitous that a man could descend it only by the use of hands, feet, and an abundance of time. To my mind, the only mountaineers that surpass the ibex are the birds.



MERCHANTS AT TOKAR

Tokar is the center of a rich cotton district, and is the point from which the author and his party set out with their caravan of camels for the habitat of the elusive ibex



TOMMY ARMOUR, THE "FLYING SCOTCHMAN," IN ACTION AT SHACKAMAXON, WESTFIELD, NEW JERSEY

Picturing Skill in Golf

A Newly Devised System of Charts Enables Golf Enthusiasts to Follow Intelligently Championship Matches

By CHAS. B. BREWER

WHEN "Sandwich, England" formed the heading of the various cables giving the news of performances at Saint George's links from May 8th to May 15th, 1928, the golfing fraternity in America watched them with the same eagerness with which they watched the 1927 cables from Saint Andrew's links in Scotland.

Walter Hagen soon formed the center of attraction, just as did, the year before, Robert T. Jones whom Americans love to refer to as "Bobbie" Jones. Jones, busy with his law practice in Atlanta, did not play in 1928.

Hagen kept playing irresistible golf, if such term may be used in connection with the steadiness with which he would climb over each of the others whose stars would seem to be in the ascendency. The brilliant play of "Wild Bill" Melhorn on May 9th, which would have won the title if continued, was overcome by the steadiness and persistency of Hagen. In the same manner Hagen outdistanced the spectacular playing of Jose Jurado, the little Brazilian player, and temporary hero, whose wonderful score of 69 on May 8th formed the best single score made during the matches on this par 72 course. Jurado also made 71 but his fall to 80 took him out of the running. Hagen's steadiness won.

THOUSANDS and thousands of golf "bugs" devoured the exciting news as the cables brought it over.

Hagen's own story was cabled on the very day he won the title. His difficulty with the hole known as "Suez" (Number 4) and his reference to another hole: "this hole has always been kind to me," and what he had to tell of this play and that was eagerly read by devotees of the game.

Much of the newspaper space given to golf plays on any certain course is wasted by a failure to state "par" for the holes played. With it, the description is pleasantly followed. Without it, the story is a study or oftentimes entirely lost.

With a "picture" which shows, first: the requirements; second: how nearly those requirements are met by actual performance; and third: an actual comparison of the playing of different players meeting the same requirements, any game may be readily vizualized at a glance if but a few moments are taken once to learn how to read such a "picture-chart."

EXAMINE Hagen's picture-chart. Hagen had difficulty with hole Number 1 on three of his four rounds. The chart shows that five strokes were required for this par 4 hole on all three occasions. Exactly the same thing happened to three of the four players shown on the combined chart (St. George's links) as may be seen by running the eye up the first column, which marks the first hole. Gene Sarazen made the hole in par. Melhorn, Hagen, and Armour failed.

On the other hand, it may be seen by glancing up the 11th column on Hagen's card, that Hagen made hole Number 11, also a par 4 hole, twice at par and once less than par; whereas, both Melhorn and Armour required five strokes for what Hagen did in three in his first round but likewise required five strokes in the third round.

The ten "birdies" which, with the steadiness of his play, gave the 1928 British golf title to Walter Hagen, are readily distinguishable by the frequent upward rise shown on his card. Two are shown in his first round; the first for Number 5 hole and the other for hole Number 11. Three "birdies" follow in both the second and third rounds. Two in succession are shown in both these rounds—the fifteenth and sixteenth holes of the second round and the sixth and seventh of the third. The two added to the list when the fourth round was played, gave him his par 72 for the round.

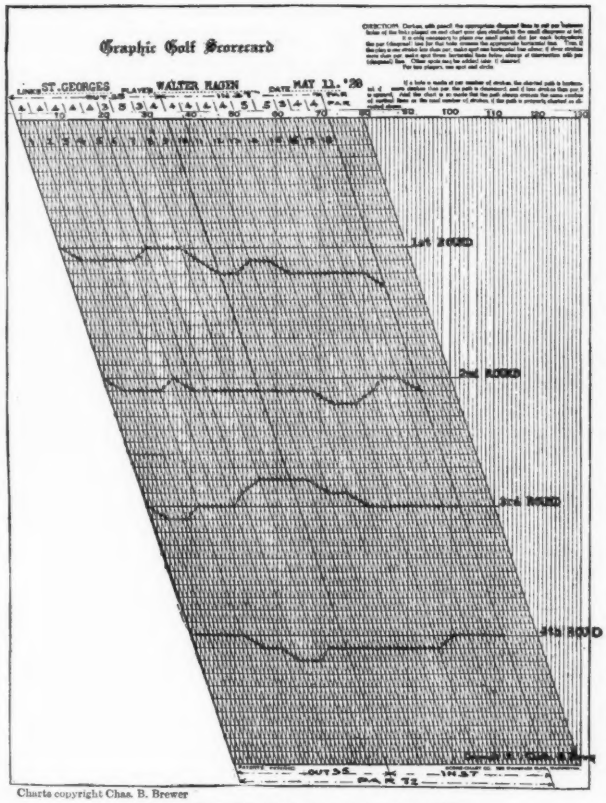
THE crowds which followed Bobbie Jones around Saint Andrew's course in Scotland in 1927 were soon rewarded. When he reached the fifth hole on his first round he played that par 5 hole in 3 strokes. The sharp incline shown on the chart at this point plainly marks the "eagle." This was immediately followed by a "birdie," then by a par play, to which were added two "birdies" in succession. Thus 15 strokes for what par asked 20 are shown on Jones' chart by the 15 dots on that many vertical lines of the fifth to the ninth holes, inclusive.

From the "picture" of this part of

the play, as shown in the illustrations, is readily distinguishable the most brilliant part of the excellency of the golf which has made our "Bobbie" Jones the admiration of two continents. He made this par 73 at 68 as against his notable playing of par 72 at 67 in his final round the following month—August 27, 1927—on the Minikahda links when he won the American Amateur Golf Crown. His total score, however, at Saint Andrew's, Scotland, was 285 for the par requirement of 292. How phenomenal was this playing is well illustrated by a comparison with the excellent playing shown by Hagen's chart which records a total score of 292 for a par requirement of 288.

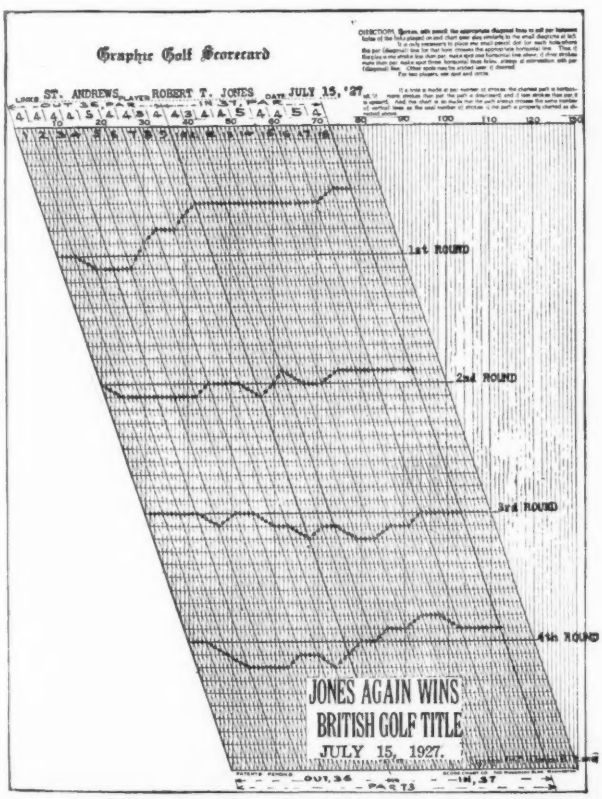
A moment's glance at the charts will show them to be so simple that few will escape their meaning if the text has been read thus far. For the benefit of any who may not have so read, it may be added that the charting of a play may be started on any horizontal lines which are crossed by a vertical line marked with a "10," "20," "30," or "40," in order to facilitate the count provided at top. The 10, 20, 30, or 40 is, of course, subtracted from the final figures.

For a play one *less* than par, the line extends to the point where one line *above* crosses the next "par" diagonal line; if two less, to the point where the *second* line above crosses the next "par" line. Likewise, if the play is *more* than par, the line extends downward and meets the next "par" diagonal line at a point where it is crossed by the *first* horizontal line *below*, if one more stroke than par is required. If two more strokes than par are required the line extends to the *second* horizontal line below. In his playing of the 13th hole, as shown on the chart dated May 9, Tom Armour illustrates a play where three strokes more than par were required, and the line extended *three* lines *below*. He recovered, however, on the next hole, playing that in one above par, and the next two in par. Two holes in one below par followed.



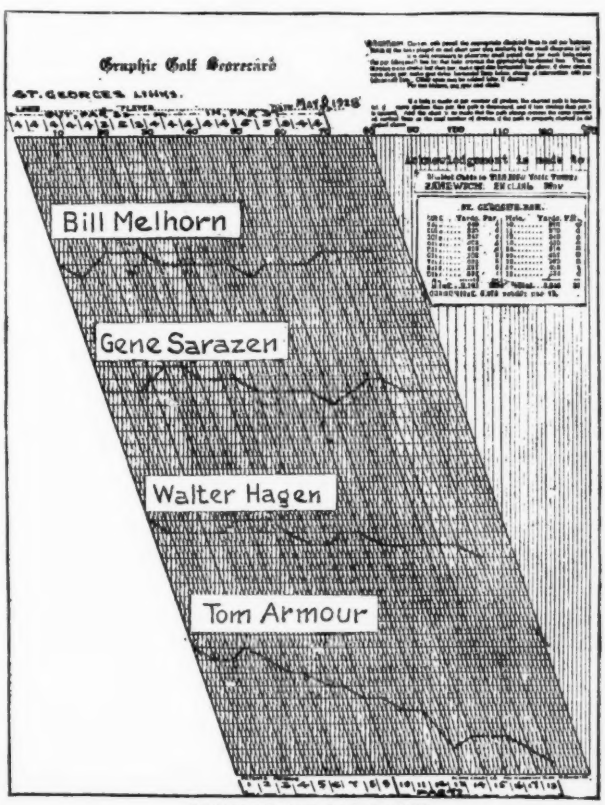
HAGEN PLAYS ST. GEORGE'S

After learning to decipher these charts, the reader will be able to see at a glance just how each hole of the four rounds was played



JONES AT ST. ANDREW'S

In the first round, the "eagle" on the fifth hole is plainly shown by the sharp upward bend. This was followed by a "birdie"



FOUR CHARTS IN ONE

By placing the graphs of four players on one card, it is possible to contrast the play hole-by-hole, and to visualize the entire round

The Hunt for the Hub of the Universe

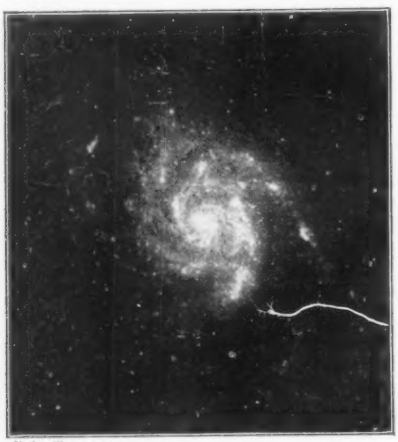
New Research Reveals the Long Sought Hiding Place of the Central Nucleus of the Galaxy, Confirming the Belief that We Live in a Spiral Nebula

By HENRY NORRIS RUSSELL, Ph.D.

Chairman of the Department of Astronomy and Director of the Observatory, Princeton University
Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington

THE autumn meetings of the National Academy of Sciences are held each year in a different place. The one which is just over at Schenectady will be remembered by those who attended it for the hospitality of an old college and a modern industrial laboratory, and also for a number of important scientific communications. Among these the most noteworthy were those dealing with astronomy.

One of the dearest hopes of the astronomer has always been to "fling



Yerkes Observatory

AN EXTRA-GALACTIC NEBULA

Our Galaxy, if viewed from without, would probably display this kind of a central condensation, and perhaps spiral arms

his plummet down the broad deep universe" and find bottom at last. That there was a bottom to find we have known since Herschel from his counts of the numbers of stars visible within the field of his great telescope showed that far down the Milky Way the fainter stars were relatively much less numerous than in it. This conclusion has stood the tests of a century of criticism—we still accept his deduction that the "universe" of stars which constitutes our Galaxy is a vast flattened assemblage, thinning out at a relatively small distance in a direction of the galactic pole but extending much farther in the plane of the Milky Way. Where is our system located within the starry universe? At the center, the edge, or somewhere between?

It has been known for a good while that we are nearly but not quite in the diametral plane which runs through the middle of the thickness of the Galaxy. This is sufficiently proved by the fact that the central line of the Milky Way itself divides the heavens almost into equal hemispheres. It is actually a degree or so nearer the southern galactic pole, whence it appears that the sun is slightly to the north of the exact median plane, but its distance from the latter is small, only a few hundred light years at most.

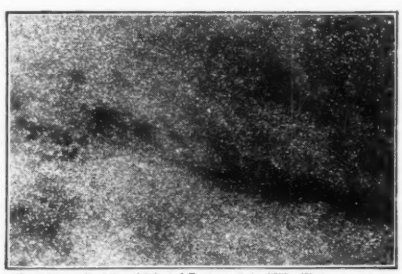
Whether our position as plotted on the galactic plane itself is near the center is hard to determine. Counts of the stars visible to the naked eye, or even those which can be seen in the small telescope, show about the same numbers for equal areas of the sky all around the Milky Way, and for this reason it was long supposed that we were near the center of things. But we now know that the soundings on our chart all came out the same because they should all have been recorded "no bottom." The distance to the confines of the Galaxy in its own plane, even when these are nearest, exceeds that at which even the brightest stars are individually visible in a small telescope. We must extend our study to the fainter telescopic stars if we are to hope for success.

THE first real idea how far we were out of center came a dozen years or so ago, when Shapley, then at Mount Wilson, applied a new and far more powerful method of determining stellar distances—the photometric. There are many kinds of stars which can be picked out by physical properties—variability, peculiarity of spectrum and the like, and the stars of many of these classes are of very great luminosity. The story has often been rehearsed how the true brightness of the Cepheid variables was found to depend upon the period, ranging from 100 times that of the sun for a period of a few hours to that of 10,000 suns for a period of a couple of months; and how, once this had been determined, distances 100 times greater than any which had been measured could be worked out.

In particular, the globular star clusters found themselves to form a gigantic assemblage or cluster bisected by the plane of the Galaxy, more than 200,000 light years in diameter and with its center about 50,000 light years from the sun, in the direction of the constellation Sagittarius (more precisely in 327 degrees galactic longitude and 0 degrees galactic latitude).

The Milky Way in this region of the heavens is far brighter than in the opposite quarter; but it is cut up by great dark lanes and patches. No one doubts longer that these dark regions are obscured by immense dark nebulae—clouds of dust or "fog" in interstellar space would appear much broader and still brighter. The obscuring clouds, or some of them at least, are associated with visible stars in such a way that we can estimate their distances, which are found to be only a few hundred light years. Could we get behind these clouds and see the Milky Way unobstructed it would appear much brighter and more extensive. But it would be almost as far away as ever.

THE photometric method of measurement, which has been so effective with the globular clusters and even with the remote spiral nebulae, is eminently adapted for an investigation of all parts of the Milky Way itself. An extensive and very well planned campaign for such a study has been initiated at Harvard by Dr. Shapley, and the first results reported at Schenectady make very remarkable news. Thousands of plates have already been taken and thousands more will be, for the completion of the program will take 10 or 15 years more. Only a few of the 240 different fields, which among them cover the whole extended Galaxy, have yet been studied, but these few have told a great deal.



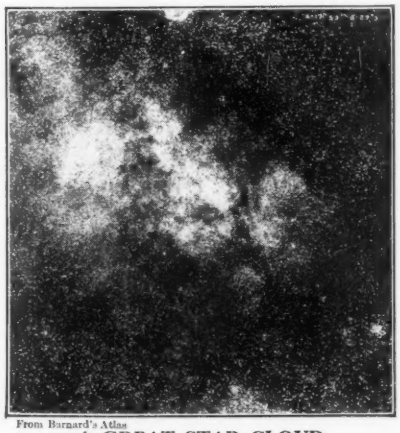
From Barnard's Atlas of Selected Regions of the Milky Way

DARK CLOUDS OF DUST

"The Milky Way in this region of the heavens is cut up by great dark lanes and patches." One of the great dark lanes

One region in particular, about eight degrees square, on the borders of Scorpio and Ophiuchus, has been found to contain no less than 450 variable stars. Seventy-two of them were known before Miss Swope began a systematic study of the photographs a year ago. Almost 400 more have since been found. They are all faint (the brighter ones having already been picked up) and this means that they are a long way off. Seventy-eight of those stars are shown by two observations to be of the "cluster-variable" type with a restricted range of variation (about one magnitude) and short period ranging from seven to seventeen hours. Previous studies of these stars in other regions have shown that they are with remarkable uniformity about 100 times as bright as the sun. The distance of each star may therefore be calculated as soon as its type of variation and average apparent brightness have been found. Twenty percent of them lie at distances ranging from 21,000 to 30,000 light years. The rest are fainter and range from 35,000 to 55,000 light years, with a sharp concentration about the middle of this interval. These stars lie within a few degrees of the direction of the center of the system of globular stars and at substantially the same distance.

IT appears, then, that there is actually an enormous mass of stars concentrated near this point which forms the central nucleus of our Galaxy. Observations in neighboring regions of the sky will be required to define fully the outline and limits of this vast star cloud. But the existing material indicates that, measured to its outer limits, it is some 55,000 light years thick and probably even larger in diameter. The exact center is hidden behind one of the dark obscuring nebulae perhaps only a hundredth part as far away. But the starry mass behind shines around the cloud on all sides and appears here and there through gaps in it, so that we may hope in no long time to have a reliable idea of its extent.



From Barnard's Atlas

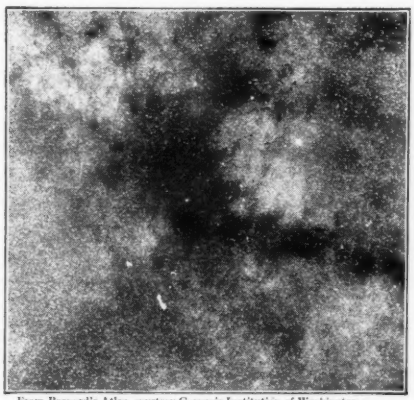
A GREAT STAR CLOUD

A rich region, part of the nucleus of the Galaxy, across the galactic equator in Sagittarius. Negative made at Mount Wilson

Viewed from a far distant point millions of light years away, at an angle to its own plane, the Galaxy would thus show a prominent central condensation—as most of the extra-galactic nebulae do. Whether the stars outside this form subsidiary condensations, and whether these are arranged in spiral arms, no one yet knows, but a decade of work may enlighten us.

This new evidence of the enormous extent of our stellar system indicates that it is many times larger than any of the known nebulae. The great nebula of Andromeda, the largest of these, is about 40,000 light years in diameter, so that there seems to be abundant justification for Shapley's remark, "If these are island universes, the Galaxy is a continent."

One difficulty may arise in the reader's mind. How can we be sure that there is not some thin, uniform haze in space between us and the distant stars which makes them look fainter than they otherwise would, and exaggerates their calculated distances? This is a fair question, but the answer is ready. The photographs show a number of small, faint nebulae of the extra-galactic type among the stars of the great cloud. There is practically no doubt that these are island universes seen through the open spaces between the stars, and probably many hundreds of times farther away even than the latter. If these excessively remote objects are visible, space must be clear of haze in their direction.



From Barnard's Atlas, courtesy Carnegie Institution of Washington

MORE OBSCURING MATTER

In Ophiuchus, between plates above and below. All three plates are eight degrees square. The regions are visible in summer

Very good evidence in further support of this conclusion was also reported by Dr. Shapley. Studies of the nebulae in the region of Coma Berenices and Virgo, in which they are very numerous, have revealed the existence of a great cluster of nebulae whose distance Shapley estimates at 11,000,000 light years. Two or three smaller clusters of fainter nebulae which appear not far off in the heavens must be much more remote; and besides these, and scattered all over the sky, are a multitude of nebulae fainter still, and forming a still more distant background. Measuring the apparent diameters and brightness of all these, Shapley and his colleagues find that, on the average, nebulae which send us 1 percent as much light as the brighter group show 10 percent of their apparent diameter. This is just what we should expect if inter-nebular space was perfectly transparent and the nebulae themselves averaged up to the same size in different regions. If space were hazy, the distant nebulae would look fainter but no smaller, and the relation between apparent size and apparent brightness would be different from that which is observed.

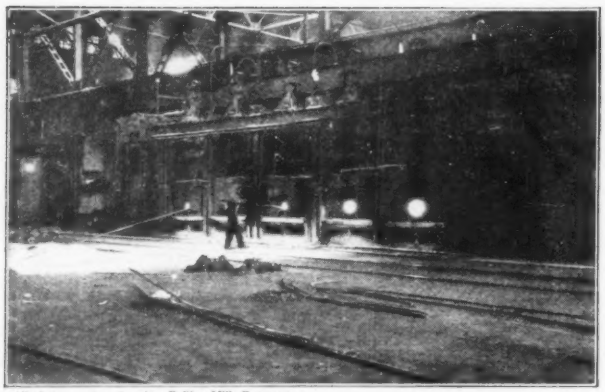
From Barnard's Atlas, by permission

PART OF THE NUCLEUS

The region of star clouds the author refers to, in which the 450 variables were studied on the Harvard Observatory plates

THIS important observation confirms a conclusion previously reached by Hubble, from his counts of the numbers of nebulae of different apparent magnitudes; namely, that there is no perceptible weakening of light in its passage through space, even out as far as the remoter nebulae. Nebulae have already been observed which are in all probability more than 100,000,000 light years distant. With the great telescope which is soon to be constructed this limit may be pushed as far as a thousand million light years. So far as study has gone, there appear to be vast numbers of nebulae at the very limits of visibility and there is no reason to believe that an end can be reached by any means now in prospect. One recalls again the words of Rosetti's sonnet, picturing one gazing toward the far horizon.

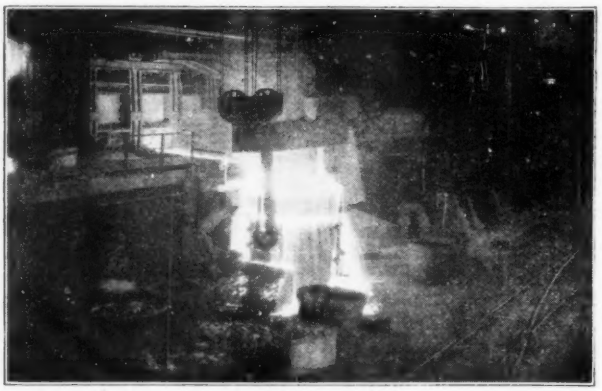
"Miles and miles distant though that grey line be,
"And though thy soul sail leagues and leagues beyond;
"Yet leagues beyond those leagues there is more sea."



All photos courtesy American Rolling Mills Company

WORKING A HEAT

Constant care is necessary to secure the required content. The operator watches his charge as a housewife watches her cooking

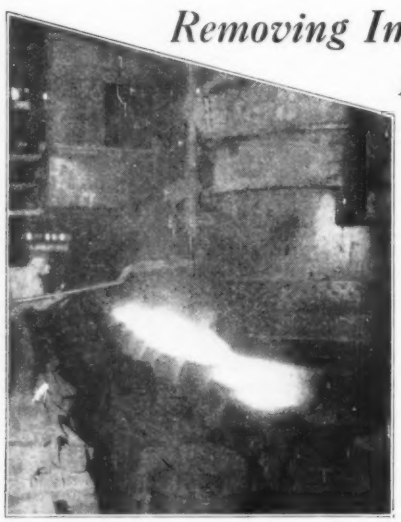


MOLTEN SLAG

The slag floating on the top of the mass of molten metal overflows the waiting ladle when the open hearth furnace is tapped

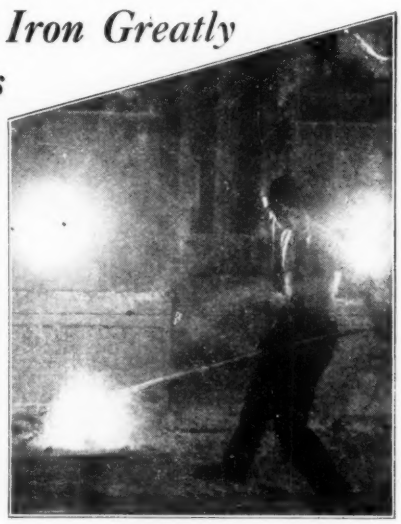
In The Birthplace of Pure Iron

Removing Impurities From Smelted Iron Greatly Increases Its Usefulness



TAPPING

Here is the apparatus which controls the flow of the molten iron from the ladle



TESTING

A test spoonful of molten iron is taken from the seething bath in the furnace

THE romance of iron, a metal more important than silver or gold, has been interwoven with the development of civilization since the dawn of history. Wrought iron was first produced direct from the ore. The reduction of ore to malleable metal takes place at low temperatures, so that it was possible for the early workers to make it with their primitive equipment. The advent of the Bessemer process revolutionized the practice of iron making. A new material, steel, that in the earlier stages was not differentiated from iron, had come into being. The open hearth furnace had been perfected; and for the first time in history the different phases of the production of such finished products as sheets were gathered together at one plant.

Prior to 1905, the mid-western farmers complained to the United States Department of Agriculture that their fences were rusting out rapidly. The department investigated and discovered that corrosion was in direct proportion to impurity content of the iron. One mid-western iron manufacturer, who recognized the importance of scientific investigation, turned his entire research resources upon the problem of developing a pure iron that would resist corrosion. In 1908, the first time in metallurgical history, and contrary to the established theory as written down in the authoritative metallurgical text books of the day, a commercially pure iron was made in a modern open hearth furnace.

THE manufacture of this pure iron is indeed a stirring sight. The whole process from start to finish is carried out on a magnificent scale. The huge blast furnace, often a hundred feet high, roars away at its task of smelting iron ore night and day, week in and week out. Every four hours it discharges a fiery stream of molten iron which runs into a ladle that looks like a Zeppelin on wheels. (See page 257, September issue, SCIENTIFIC AMERICAN.) The metal is extremely high in carbon content, and if cast, is too brittle to be worked; so from the blast furnace it journeys several miles in this giant "thermos-bottle" to the open hearth furnaces where the work of refinement goes on.

The open hearth furnace is a huge covered hearth about 75 feet long, shaped like an oval saucer. Upon this play the incandescent flames from the gas producers. With a quantity of melting-stock, the molten pig iron is plunged into the open hearth where the material seethes for hours. Here most of the detrimental, rust-promoting impurities in the metal are burned out.

Periodically, the furnace operator takes a test sample of the molten metal which is sent to the laboratory for careful analysis. Occasionally, materials are added to aid the purification, until finally, the analysis reaches the set, and rigidly-adhered-to, standard. Then there is much bustle and hurry in the neighborhood of the furnace. The great, spidery crane approaches from out the shadows. Its long, tentacle-like hooks drop down and grasp the waiting ladle. At a signal from the furnace operator, the plug that dams the molten bath is knocked out, and, with a thundering roar, the molten iron crashes into the ladle, sending up showers of sparks.

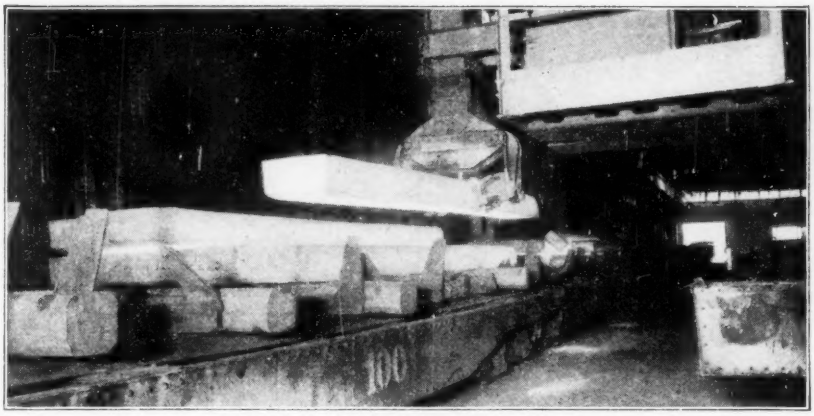
For perhaps 15 or 20 minutes this blinding flow of light and heat continues until, with a wave of his hand, the operator signals the crane man to remove the molten iron, to be poured

into the waiting ingot molds. At the proper moment the ladle pourer lifts a release lever on the side of the ladle, and the liquid iron pours into the top of the upright molds. When the molds are filled, a donkey engine attaches itself to the waiting string of mold-laden buggies and hauls them away into position under the stripper crane.

As soon as the metal is solidified, this crane extends its claws, grasps each mold, and lifts it from the gleaming ingot. Another crane swings these ingots up and throws them into the yawning maws of the nearby soaking-pits. Here the temperature is equalized throughout the ingot. The center is allowed to solidify, while the outside is held at rolling temperature. When this is accomplished, the overhead crane again plunges its two fingers into the blazing pit and snatches out a dripping ingot. Incandescent with pent-up heat, the ingot is placed on a roll-train which quickly conveys it on its way. The great blooming-mill rolls spread wide their crashing jaws to receive it. Back and forth the ingot passes, growing longer and thinner until it looks like a ribbon of light.

HERE the ways of the old and the new methods part. In the old practice this "bloom," which was an ingot, passes on to the bar mill for further reduction. Presently, it is cut into lengths, just the width of the finished sheet to be rolled. These lengths are re-heated and passed by hand back and forth between rolls, until they assume the appearance of flat sheets ready for the manufacturer. They are then cleaned in an acid bath to remove surface dirt.

Next, the sheets are enclosed and sealed in heavy cast iron boxes, and pushed into furnaces to be annealed. Here the temperature is just high enough to remove all the strains in the metal, caused by rolling. They emerge from these furnaces a day or two later, soft and ductile, so that they can be formed, drawn or stamped. After the sheets are annealed they are again passed between rolls to be flattened.



ELEVEN-THOUSAND POUND SLABS

This huge crane tosses these eleven-thousand pound slabs around like match sticks. Here you see them being loaded, red hot, on massive and specially constructed cars made of steel

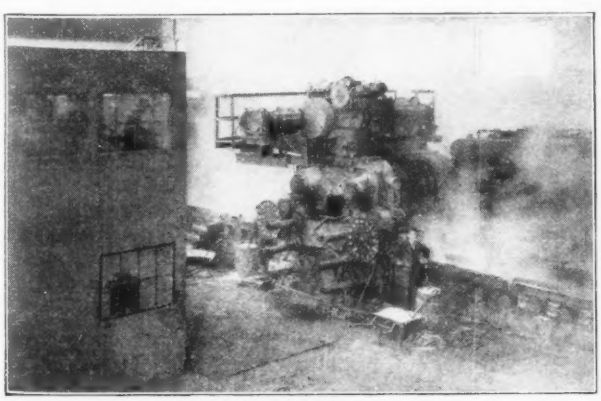
Harking back to the parting of the ways—how different is the modern method from this old method of hand rolling. Instead of tedious "back-and-forth-between-the-rolls" practice that has been in vogue for over 40 years, the blooms are taken from the blooming mill and placed in a holding furnace. Presently, they are shoved from this furnace to land automatically on roll-trains that carry them away to a "universal mill." With a vicious hiss the red-hot slab of metal strikes the first water jet curtaining the rolls of this mill. The rolls spread wide their jaws to receive the bars. Almost more quickly than the eye can travel, the bar shoots through the universal mill and along the roll-train that seems to slope away indefinitely into the distance.

FRACTURE

Castings, broken in two, enable experienced operators to read the carbon content

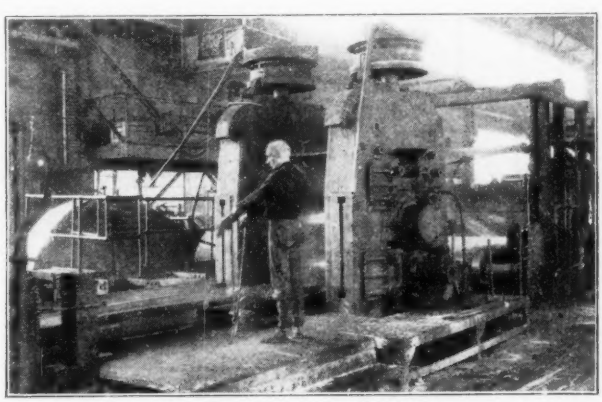
WHILE strips are nothing new in the industrial world, a continuous strip of metal 36 inches wide is just 16 inches wider than the maximum strip produced previously in this country. In these mills, four rolls high, a great reduction in thickness takes place. The short, fat bar that came from the holding furnace is now a long strip of sheet iron. It moves faster and faster as it passes between three more four-high mills. Leaving these, the long strip plunges into a slot in the wall of a long, low, box-like structure. Before you can run to the opposite end it is already streaming out.

This structure is a continuous pickling machine. Immediately after the strip emerges, it is washed and dried. This transpires in less than the time it takes to write about it. Then the



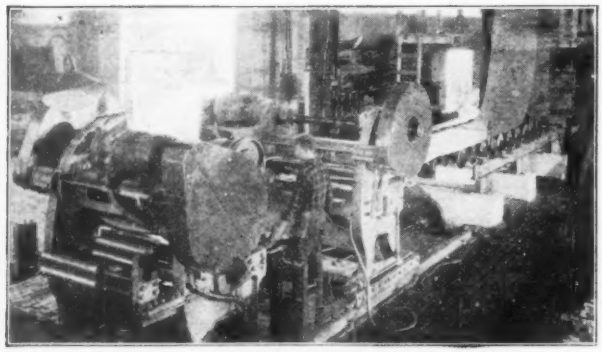
A HUGE MILL

This universal mill rolls the hot ingots into slabs for the continuous mill. The building at left houses the controlling apparatus



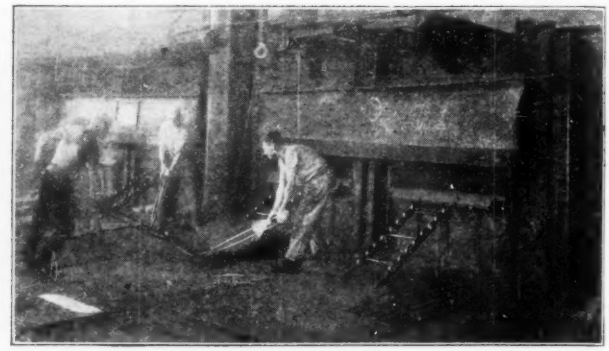
WATCHING THE RIBBON

Immobile he stands, watching the ribbon of cherry-red metal elongate as it dashes through the rolls on its continuous passage



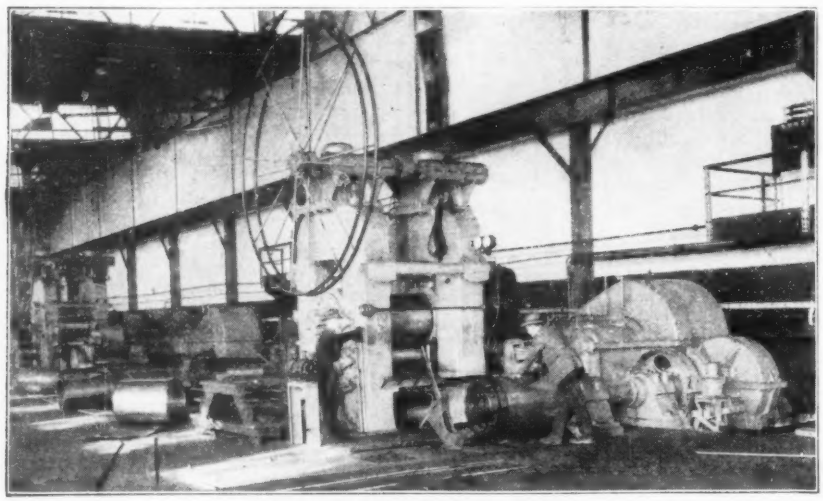
MIGHTY SHEARS

The continuous tandem shears make it possible for the sheets to be handled separately through the various finishing operations



REHEATING

Before being rolled further the sheets must be reheated to bring to a rolling temperature. The sheet is being put in the furnace



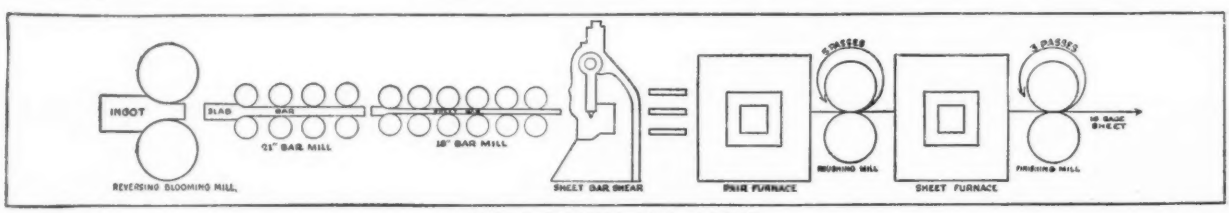
MAMMOTH FINISHING ROLLS

These great rolls serve to give the high finish which is so essential in modern automobile construction. The adjustments are capable of great refinement. Note the size of the rolls

strip plunges into a continuous annealing furnace, passes rapidly to the coiler and, almost before you can realize what is happening, the 60-foot length of sheet iron is coiled tightly, picked up by the crane, and carried to the storage rooms.

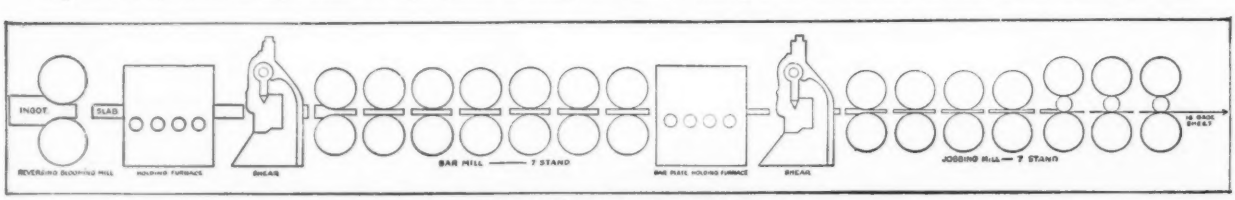
From the storage rooms the coils are drawn as they are needed, decoiled, and cut into desired lengths. These may need further rolling, depending upon the purpose for which they are used. If the sheets do need further treatment, it is done by the hand method as in the old practice. One of the marvels of the new process is the fact that this new strip sheet mill can turn out as much sheet metal as 40 of the old type mills, which operate more slowly, could produce in the same space of working time.

WHAT is to become of this vast output of sheet iron? If you will look around you, you will quickly see the answer. In every field of industry sheet iron plays an important part. Railroads absorb vast quantities of it for roofing and sides of their buildings and for culverts. Manufacturers of household products such as porcelain-enameled ice boxes, stoves, kitchen tables, and countless other products consume thousands of tons of sheet iron from which they fashion their products, because the ceramic enamel adheres best to pure iron. The oil industry draws endlessly upon pure sheet iron for pipe lines and tanks. The general building trades are tremendous users of pure iron for roofs, gutters, ventilating systems, et cetera. A list of users for pure iron would be an endless one, growing longer every day, and every product offers a new chapter in the romance of manufacturing.



MILLS OF THE OLD ORDER

This schematic diagram (courtesy *Iron Trade Review*) shows the sequence of operation through which an ingot passes in being reduced to a slab and finally to a 16-gage sheet on conventional hand mills. This process, as described in text, is slow and very costly



THE CONTINUOUS PROCESS

This schematic diagram, for which we are indebted to the *Iron Trade Review*, shows the stages through which an ingot passes in being rolled to a slab on a bloomer and finally to a 16-gage sheet on the continuous process installation at an Ashland, Kentucky, plant

The "Sinking" Tower of Pisa

By ALBERT G. INGALLS

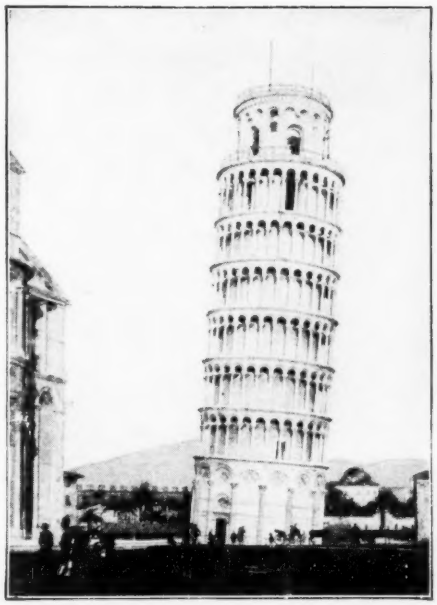
FOR centuries the famous Leaning Tower of Pisa has been sinking vertically into the soft river valley sediments on which it rests, at the average rate of a millimeter a year. That long-continued process is now about to be brought to an abrupt and permanent stop. If the present plans of the Italian government are carried out as vigorously as work has already been begun, the ancient tower, which has stood on a poor foundation since A. D. 1174, when its construction was started, will soon be equipped with a broad, secure footing. Yet the structure itself will not have been moved an inch in the process, either up or down or sidewise.

EMPHATICALLY the Leaning Tower is not to be straightened up. While a restoration to the intended vertical, doing away with its 14 feet of inclination in a total height of 178 feet, might make appeal to the severely practical minded, yet it would also do violence to the sentiments long connected with this historic structure. There are many other beautiful campaniles in the world but there is only one Leaning Tower of Pisa.

The plan which will be pursued, short of some unanticipated discovery which might conceivably alter it, is to inject cement in liquid form through pipes inserted under the Tower, by one of the well-known cementation processes which are now being employed in certain kinds of engineering work where direct access is difficult or impossible. This work will doubtless be performed by the firm which is at present carrying on preliminary experiments at the site of the Tower; the same firm, in fact, which is at present safeguarding St. Paul's Cathedral in London by cement injection, as previously described in the SCIENTIFIC AMERICAN.

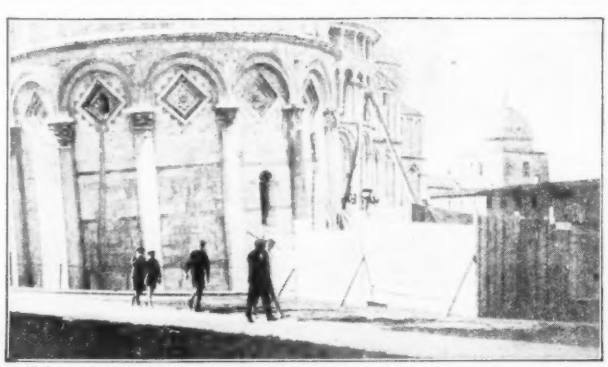
Late last autumn when the operations at Pisa were inspected, a most interesting large-scale test experiment was found to be in progress. Instead of proceeding directly with the injection of cement under the priceless Tower, an operation whose complete success would possibly be problematical, the *Commissione Ministeriale per la Torre di Pisa* of the Italian government has let to the François Cementation Company, Ltd., of Doncaster, England, the contract to carry out a series of preliminary experiments upon the soil at spots to be chosen as near the Tower as can be tested without involving direct risk to it. These experiments should provide valuable and exact data concerning the bearing resistance of the various strata of sand and clay in the neighborhood and to a considerable depth. These data will include the pressure at which the cement can be injected into the ground; the quantity of cement the ground will take; the increased bearing resistance obtained; the condition of the treated ground after varying intervals of time; unit factors of time and cost; information as to the best sequence of operations; depths of injection, and so on. The large scale experiment partly shown in one of the illustrations will be duplicated on a number of plots within a like radius from the Tower. Finally, and in the light of the experience gained by the experiments, the soil directly under the Tower itself will be tenderly and cautiously operated upon.

At the time mentioned, one small job was nevertheless taking place directly under the Tower. This, however, had nothing immediate to do with the repair of its foundations, but consisted, rather, in the careful extraction of sample cores of earth four inches in diameter and several fathoms in length. The sampling equipment shown within an enclosure in one of the illustrations, was set up successively on each of the four sectors immediately adjacent to the Tower and cores were taken in an inward slanting direction, thus providing samples from beneath it. These cores, it is of interest to note, do not agree closely in stratification with other cores made only 200 feet from the Tower. This is not surprising, as the various strata of sand and clay in the entire neighborhood represent river estuary deposits and such strata are apt to vary quite radically in nature within short distances. This emphasizes and confirms the need of making a whole series of test experiments as described, in order to insure success.



WHERE GALILEO TRIUMPHED

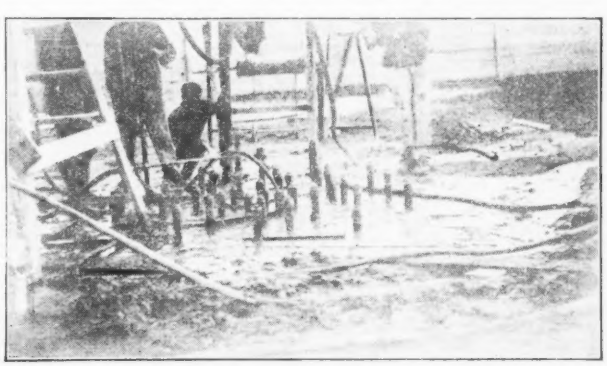
Here the famous experiment on the relative rate of descent of falling bodies took place



All photographs by the author

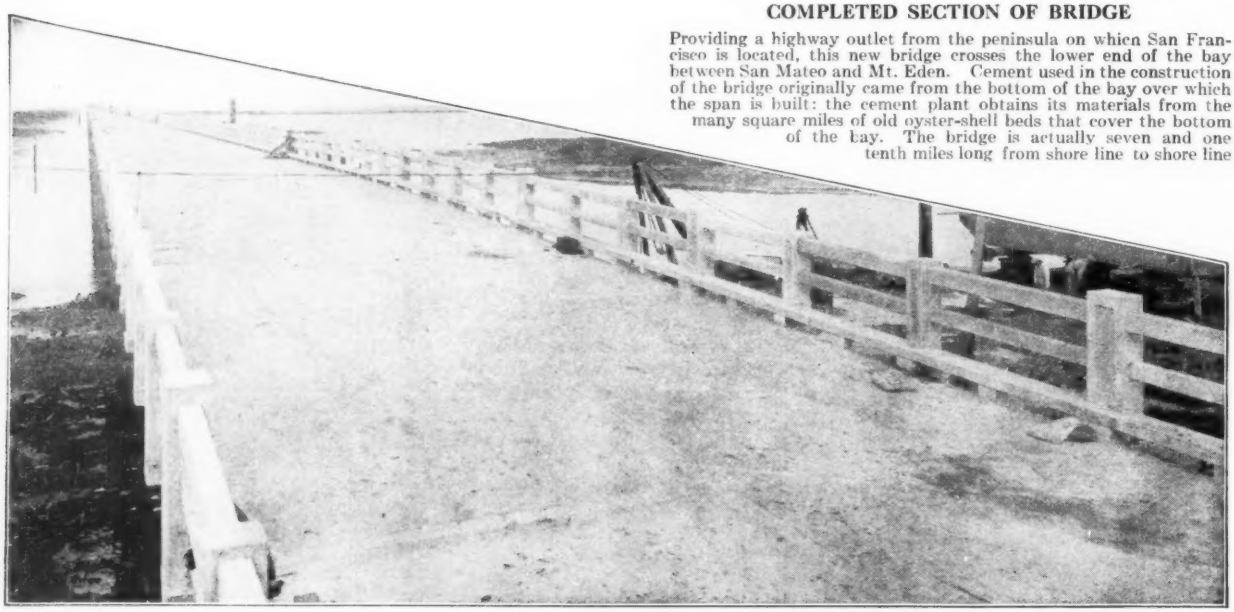
WHAT IS UNDER THE TOWER?

A core drilling machine projects above the temporary enclosure. Here samples of the sand and clay beneath the Tower were taken



PART OF A TEST EXPERIMENT

A hose line may be seen connected to one of the vertical pipes. Nearby were cement mixers and heavy pumps for injecting cement



COMPLETED SECTION OF BRIDGE

Providing a highway outlet from the peninsula on which San Francisco is located, this new bridge crosses the lower end of the bay between San Mateo and Mt. Eden. Cement used in the construction of the bridge originally came from the bottom of the bay over which the span is built: the cement plant obtains its materials from the many square miles of old oyster-shell beds that cover the bottom of the bay. The bridge is actually seven and one tenth miles long from shore line to shore line

A Pre-cast Seven Mile Bridge

Concrete Bridge Across the Bay Below San Francisco Is Made Up Almost Entirely of Pre-cast Units

By CHARLES W. GEIGER

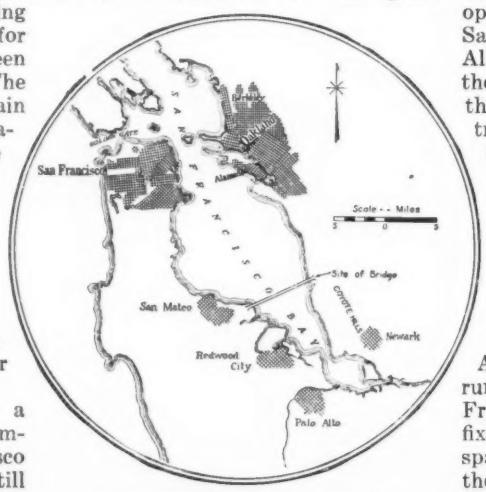
EVER since the days when the padres trod their laborious way along *El Camino Real* around the southern end of the bay from San Francisco, in order to reach the missions to the east and north, the crossing of San Francisco Bay has presented a problem.

With every stage in the bay region's development that brought increased population and increased traffic congestion, that problem became more pressing. For a generation or more there has been agitation for bridging the bay, and innumerable projects for accomplishing that purpose have been discussed, promoted, and shelved. The advent of the automobile made certain that the demand for easy communication between San Francisco and the mainland would eventually force an answer.

IN spite of a great increase in ferry facilities during the past ten years, the congestion of motor traffic on San Francisco's few outlets, water-bound as the city is on its peninsula, has reached greater and greater degrees of density.

While the question of building a direct bridge to accommodate commuter traffic between San Francisco and Oakland remained—as it still does—without solution, the organizers of the San Francisco Bay Toll Bridge Company conceived the plan of a low-level bridge farther to the south, that would not only serve automobile traffic between the two sides of the bay, but would provide an easy avenue of communication to the city for the rapidly increasing freight and passenger traffic from the great central valleys of the state and from the east.

A location was sought that would combine the advantage of being close enough to San Francisco to relieve the traffic congestion, and that of economical construction by utilizing the shoal waters that stretch along both sides of the bay for many miles below the two chief population centers.



THE NEW TRAFFIC ARTERY

Location of the new bridge in relation to the city of San Francisco and other points

After extensive surveys comprehending all essential factors, such as motor travel over all routes tapping San Francisco, construction costs, and engineering features, the location was selected where the San Francisco Bay toll-bridge is now nearing completion.

THIS site lies between what is known as Little Coyote Point, opposite the foot of Third Avenue in San Mateo, and Mt. Eden, on the Alameda site, near Hayward, where the Dublin Canyon road debouches through the mountains and brings the transcontinental Lincoln Highway virtually to sea level.

The San Francisco Bay toll-bridge is 7.1 miles from shore line to shore line, making it the longest highway bridge in the world. With the exception of the piers, pile caps, and fence posts, the entire bridge is pre-cast at a plant some 20 miles distant by water.

Across the main ship channel that runs north and south through San Francisco Bay, there are four 300-foot fixed steel spans, with a central lift span of 303 feet. The remainder of the bridge between shores is of concrete viaduct construction, supported on concrete piles driven to bedrock. The concrete viaduct has 35-foot spans in

the main channel and 30-foot spans across the shoals.

The concrete viaduct is supported on four concrete piles in each bent. Approximately 5000 piles were used in the construction of the viaduct sections, the longest pile being 105 feet in length and weighing 34 tons. The piles vary from 18 by 18 inches to 24 by 24 inches. The deck is 27 feet from curb to curb, with a four and a half foot railing on each side.

THE contractors adopted a unique plan in which the girders and decking combined were pre-cast in half sections, weighing as much as 55 tons each. The four pile bents were capped on the site and when the caps were sufficiently hardened, the pre-cast deck slabs were placed approximately in position, being supported on wooden blocks 12 inches square The pre-cast deck slabs were then lined up with hydraulic jacks having ball-bearing bases, which made it possible for one man to move one of the 55-ton slabs. When the slabs were in position, the load was taken up with screw jacks which were left in position until the joints were concreted and the load taken up by the concrete, after which they were removed.

The placing of the pre-cast slabs was done with the largest floating derrick on the San Francisco Bay, having a capacity of 100 tons, which handled the slabs without any difficulty and without damage.

A special device was used for picking up the slabs. This consisted of a heavy steel girder frame equipped with four heavy steel arms, two at eacn end. These arms were so designed that they could be moved back and forth on the steel girder to enable the device to pick up different sizes of slabs.

DECK-SLAB CASTING PLATFORM

All pre-cast units were cast in a yard 12 miles north of the bridge site. This platform, on which short slabs weighing 46 tons and long slabs weighing 55 tons were cast, is 1500 feet long

AN open space of 10 inches was left between the ends of the deck slabs, to allow for the locking arrangement designed to hold the sections of the bridge together in the event of unusual stress that might be put upon them by reason of earthquakes, or by out-of-control shipping, driven against the bridge by the wind. One longitudinal bar in each girder projects beyond each end of the girder in a loop. These loops are threaded by a steel rod extending across the entire bridge at each bent and are embedded in the 10-inch concrete joint between the slabs.

One of the most interesting features of the bridge construction is the specially constructed pile-driver with four leads used in driving the piles. This pile driver is equipped with two steam pile-driving hammers for driving two piles at once. The driver equipment includes a steel derrick 135 feet in length which is used to lift the piles from barges and place them in position in leads of the driver. A special four point suspension has been worked out for picking up these immense piles. The piles were lifted from the barge and when in a vertical position, three points of suspension were removed and the pile was supported and handled by heavy cables and a special clamp, the clamp being bolted to the four vertical reinforcing bars. A pile was placed in each of the four leads of the driver and then the two hammers were lowered into position for driving and two piles were driven simultaneously and expeditiously.

SLAB-HANDLING DERRICK

Deck slabs were lifted by this 100-ton derrick from the barges and placed on the bridge bents

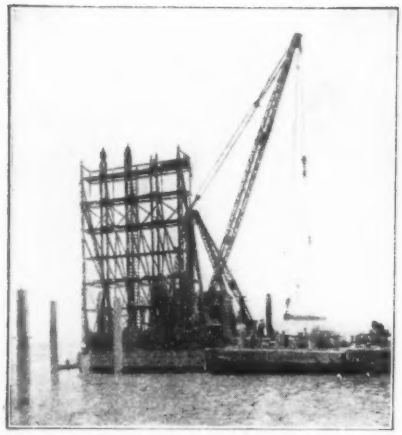
All the fence posts were cast in place, and then the pre-cast rails and curb were set. The solid appearance of this curb and rail adds greatly to the sense of safety when driving on the bridge.

As stated previously, the length of the bridge is 7.1 miles, only one mile of which is over deep water, the remainder being on tide flats with water ranging from one to four feet deep at low tide. In order that the floating equipment might work the entire length of the bridge, it was necessary to dredge a channel eight feet deep by 165 feet wide and five miles in length, entailing the movement of 1,400,000 cubic yards of material.

IN addition to the pile and pre-cast slab structure there are four 300-foot steel spans and one 300-foot lift span, supported on concrete piers. The lift span will have a clearance of 35 feet above mean high water when closed, and 135 feet when raised.

One of the interesting features in connection with the construction of this bridge was the plant where the concrete piles and the pre-cast slabs were made. The casting yard was over 1500 feet in length, there being one yard with two concrete mixers for casting the piles and another yard with two concrete mixers for casting the slab sections, the largest of which weighed 55 tons each. Between the two casting yards railroad tracks were laid with a capacity for storing 60 cars of aggregate used in the concrete.

A specially-built gantry crane having a span of 85 feet and operating the entire length of the slab-casting yard was used in handling the pre-cast slab sections. This crane was equipped with a specially-built device for picking up the slab sections from the forms and was very similar to the device used at



FOUR-LEAD PILE-DRIVER
An immense machine which places four piles at a time and drives two at a time

the bridge site for lifting the sections from the barges and placing them in position in the bridge. This device was supported from a crane traveling laterally over the top of the gantry and was provided with four heavy steel arms, two of which hooked under each end of the slab.

The slab forms were used 13 times, and were so arranged that the entire form remained in place with the exception of one side form for each rib, which could be dropped down, together with the end bulkheads. This enabled the gantry crane to lift the slabs directly from the forms and place them on the barge for transportation to the bridge site. The slab for each bay was cast in two units.

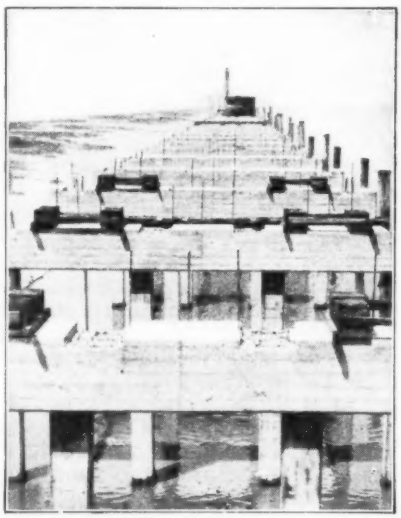
A GANTRY crane with a 125-foot span was used for handling the concrete piles and for loading them on the barges used in transporting them to the bridge site. This gantry crane was equipped with an immense steel girder or beam which carried four sets of blocks and cables for picking up the concrete piles, the weight of the piles being self-equalized through the blocks and cables on the lifting beam or girder. All piles up to 77 feet long had three pick-up bolts cast in place, and those over that length had four. These were T-headed bolts with a steel plate and nut on the bottom end. After 24 hours in the concrete, they were given one twist to break the bond. They were removed after the piles were placed on the barge and the holes filled with neat cement grout.

It may be of interest to note that, in fabricating the reinforcement, a radical change was made from the usual custom of placing the hoops in spirals around the vertical rods. The hoops were all cut to proper length and placed parallel to each other, thereby effecting considerable economy since this permitted a considerable number of men to work on the fabrication at the same time. The completed reinforcements were then placed in the forms with the crane.

By casting the slabs in this yard and then transporting them to the bridge, all the usual "false work" or use of wooden forms at the bridge was made unnecessary. The slabs were kept wet for 11 days before shipping, by covering with burlap and sprinkling with movable sprinklers.

While this is the longest highway bridge in the world, its total cost will not run beyond 7,500,000 dollars.

In order to connect the bridge proper with the main arteries of travel on the east and west, approximately five miles of graded approaches are required. A considerable section of these approaches was constructed through salt ponds, the embankment through these being graded by means of bucket dredges.



READY FOR THE SLABS
A few of the 5000 piles needed, in place with pile bents capped ready for slabs

These dredges operated from a borrow pit paralleling the approaches. Instead of following the customary method of putting a temporary pavement on the new fills, they were paved at once with a permanent concrete pavement On top of the embankment, there was placed a layer of red rock varying in thickness from six to 12 inches, according to the condition of the fill. This rock was thoroughly rolled and the concrete pavement laid on top of it. With the exception of one or two places of short length, it is not believed that there will be any serious settlement.

It will be of interest and value to watch these approaches as time goes on, and compare the cost of upkeep of the pavement with the cost of maintaining a temporary pavement and then replacing with a permanent pavement after the settlement has ceased.

THE building of this bridge is an outstanding example of efficient organization and rapid construction. The bridge company was incorporated in September, 1927, with all financing accomplished; the first contract was let and work was started in the casting yard on January 2, 1928. Approximately 250,000 dollars was spent in adapting as a concrete casting plant a section of the Alameda yards of the Bethlehem Shipbuilding Corporation on the Oakland Estuary. The preparation of the yard was completed and the first pile was cast on March 1; the first slab was cast on April 3; and the first pile driven in place on the same day. Since that day, progress has been so rapid that the last pile was driven the latter part of October, the driving of these piles being greatly facilitated by the special pile driver.

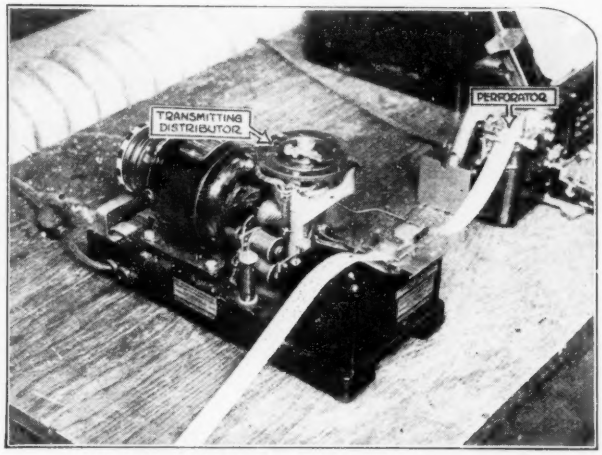
The bridge is being constructed by the Raymond Concrete Pile Company.

BINDING THE DECK SLABS TOGETHER
In addition to the three quarter inch expansion joints at every fifth slab, there are 10-inch spaces, to be filled with concrete, between the slabs. Expansion joints are asphalt-filled

Type-setting by Telegraph

SETTING TYPE MANY MILES AWAY

The equipment at the sending end of the Teletypesetter system. The operator perforates the tape on a machine similar to a typewriter

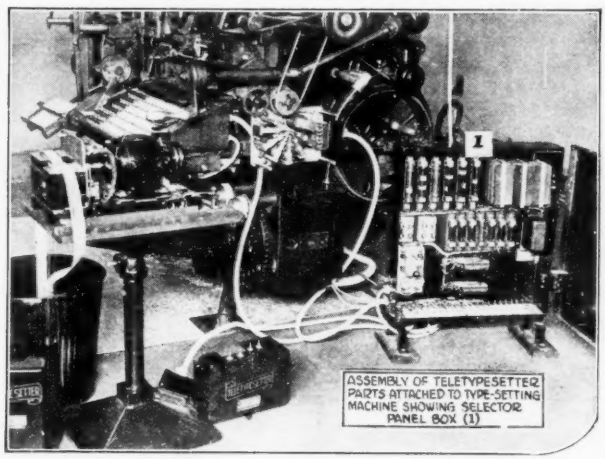


THE SENDING EQUIPMENT UNCOVERED

The perforated tape passes on through this transmitter which converts the message into electrical impulses for wire transmission

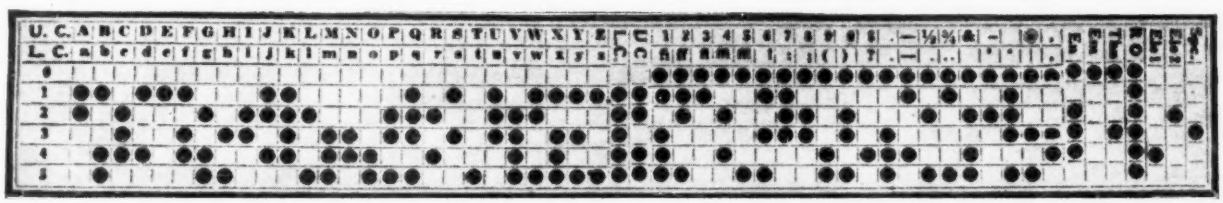
WHERE THE MESSAGE IS RECEIVED

The electrical impulses operate this machine which perforates a tape the same as the original. Another machine prints the message



THE TYPE-SETTING MACHINE CONTROL

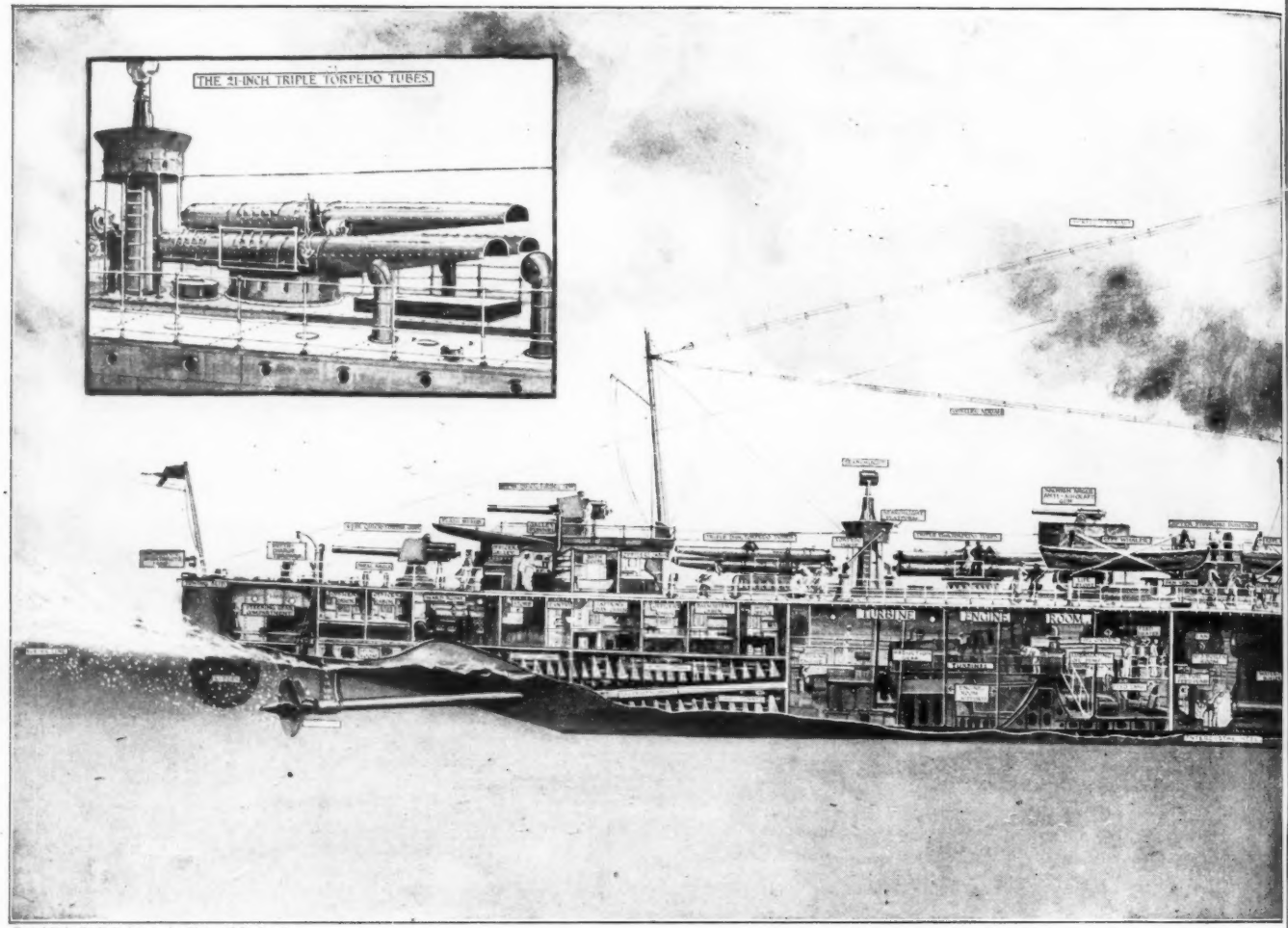
The equipment which controls all the operations of the type-setting machine and causes it to set in type the duplicate tape message



SOME years ago, Mr. Frank E. Gannett of Rochester, New York, publisher of the Gannett newspapers, conceived the idea of a machine that would set type by telegraph. The result of his initiative in beginning development of such a machine was shown in the recent announcement of the Teletypesetter. Associated with Mr. Gannett in this development are Mr. W. W. Morey of East Orange, New Jersey, and the Morkrum-Kleinschmidt Corporation of Chicago.

The Teletypesetter may be used on either the linotype or intertype type-setting machines. It is not a type-setting machine itself, but operates such a machine automatically by electrical impulses. At the sending end, a machine similar to a typewriter perforates a paper tape in code (see code strip immediately above). This perforated tape, automatically fed into another machine, causes perforation of a similar tape at the receiving station perhaps hundreds of miles away. This duplicate tape is fed into another mechanism which operates a type-setting machine at great speed. A mechanical "printer" also typewrites the message at the same time.

That this machine will have a wide field of use is unquestionable. While it was designed primarily for transmitting news more rapidly over long distances—for example, to a chain of newspapers or to subscribers of a press service—it will be of great importance in book publishing and in sending stock quotations to newspapers. Book publishers using this machine need not save tons of metal plates with which to print new editions but may simply keep files of the perforated tape rolls.



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A British Destroyer

Great Britain and Japan Have Built Many Ships of This World War Experience. The

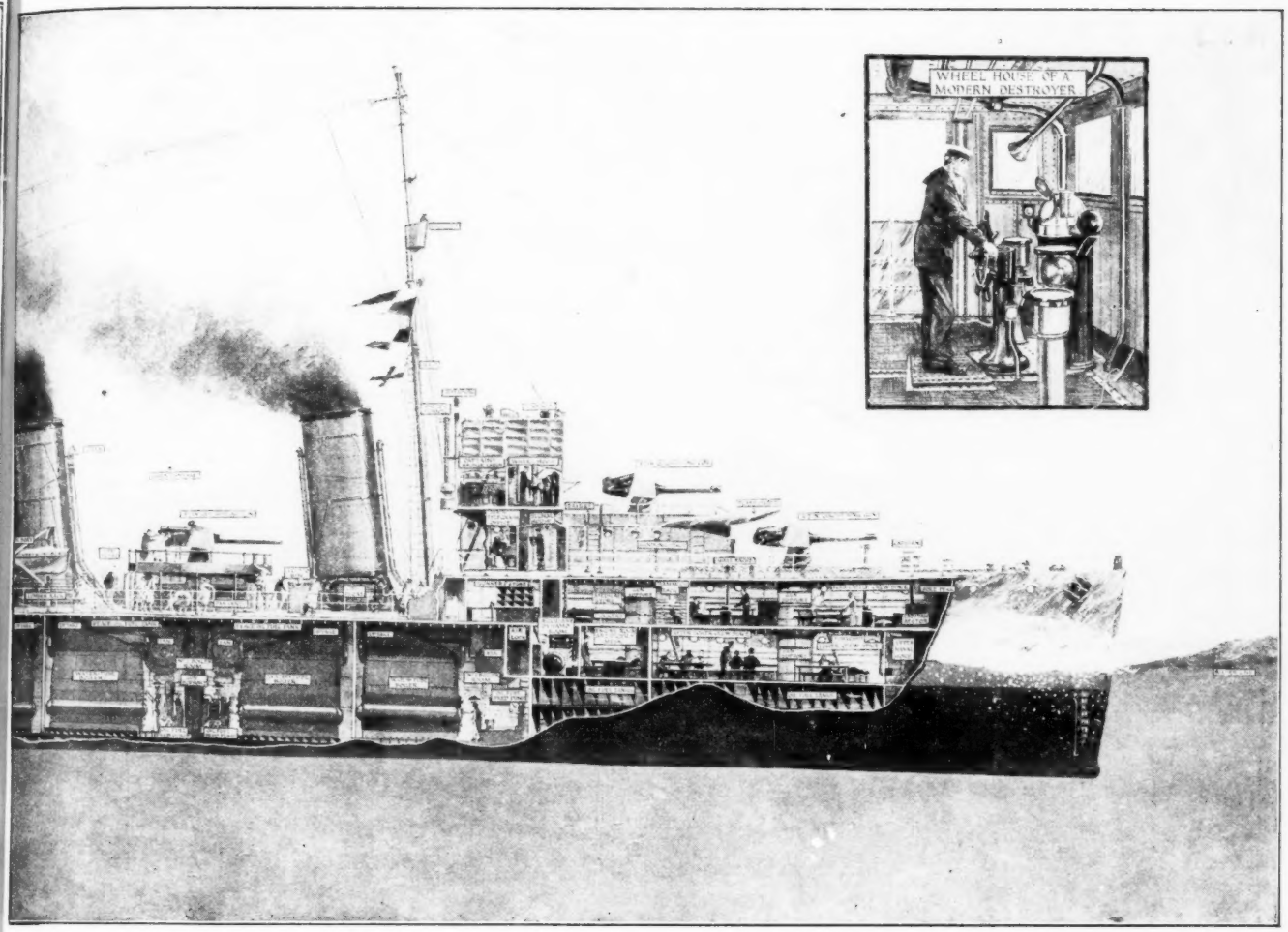
FOR its particular class of service, the destroyer is an extremely efficient small vessel, but the destroyer flotilla leader illustrated here is even more powerful. Before discussing it, however, it is well to review briefly the destroyer's history in order to understand better the potentialities of this super-destroyer.

With the advent of the automobile torpedo, there was developed a small but deadly naval ship called the torpedo boat. To combat these boats, which were used as early as the Spanish-American War, the torpedo boat destroyer was built. This ship was equipped with a number of torpedo tubes and was supplied with several guns of small caliber. In the process of its development, the destroyer became literally a shell crowded with the machinery necessary to make it a speedy, easily handled ship. It was apparently a weak ship but actual war service against German submarines proved it to be a very effective weapon. In this kind of warfare, its speed and seaworthiness were vitally important features.

HAVING demonstrated its value, the destroyer was improved during and following the war. Its size was increased; it was given more torpedo tubes—often as many as 12—and appreciable gun-power; and more powerful propelling machinery was installed. Thus the modern destroyer, an offshoot of the larger classes used during the war, is a high-speed vessel so seaworthy that, despite its relatively small size, it can remain with the fleet at sea for limited periods.

But even modern destroyers are very vulnerable due to their shell-like construction which, in turn, is due to the necessity for speed. They are effective, of course, against submarines but they cannot attack larger ships except in numbers. Attacking, *en masse*, their preponderance of torpedo tubes affords them a measure of fighting power not to be ignored.

While destroyers are primarily anti-submarine vessels, they have other important uses. During the war, they were used as escorts for transport convoys, a service for whch they are peculiarly adapted because of their speed and maneuverability. In those days, they carried a large number of depth charges—as many as 50 of these deadly "bombs" being carried by some—so it will be seen that their effectiveness is not limited to the guns and torpedo tubes they possess. They are



Leader—We Have None

Important Type Which Was Developed as a Result of United States Has Built None

also valuable for laying down smoke screens and for acting as anti-submarine screens around capital ships.

Ordinary destroyers are extremely lively and uncomfortable at sea; have limited stowage space and are, therefore, dependent upon bases and tenders; and have quarters for only the ship's complement of officers and men.

Before the end of the war, the need was seen for a faster destroyer, or flotilla leader—a ship that was large enough to accommodate a flotilla commander and his necessarily large staff; that could carry sufficient fuel, ammunition, and supplies to enable it to remain longer at sea; and that was fast enough to "run circles" around the flotilla in taking advantage of tactical opportunities. Besides these features, the flotilla leader would also have to carry extensive radio and signalling equipment and would have to be steady enough to facilitate the taking of observations for torpedo control.

To meet this need, a type was developed that has since become known as the destroyer leader. Destroyer leaders carry the same torpedo equipment as destroyers, have greater gunpower, and average in the neighborhood of 2000 tons displacement. The largest ordinary destroyers average 1000 tons.

GREAT BRITAIN and Japan quickly saw the military value of destroyer leaders and each has, since the war, built a number of them. However, while they have, respectively, 18 of 31,500 tons and 24 of 40,800 tons, built, building, and authorized, it is astonishing to note that the United States neither possesses nor has authorized construction of a single one.

The British destroyer leader illustrated above is of the "Shakespeare" class, is 329 feet long, and has a full load tonnage of 1750. It is a twin-screw ship capable of making 36 knots an hour. Its armament consists of five 4.7-inch guns and a high-angle gun for defense against aircraft. For attack on large ships, it is equipped with two sets of triple torpedo tubes for launching 21-inch torpedoes.

In contrast to this, the *U. S. S. Corry*, a destroyer of the largest type owned by the United States, is slightly over 314 feet long and has a full load displacement of 1308 tons (1215 tons normal). It is also a twin-screw ship and has a speed of 33.97 knots per hour. Its armament consists of four 4-inch 50 caliber guns and one 3-inch 23 caliber anti-aircraft gun. It has four sets of 21-inch torpedo tubes.

The Romans in East Anglia

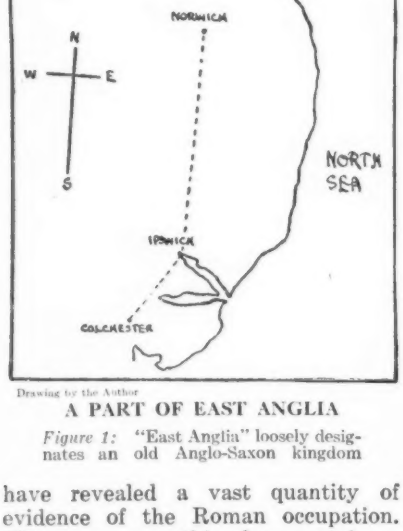
New Excavations Reveal Fresh Evidences of the Roman Occupation of Ancient Britain

By J. REID MOIR

Fellow of the Royal Anthropological Institution, Member of l'Institut International d'Anthropologie
Past President of the Prehistoric Society of East Anglia

THE AUTHOR

DURING the turbulent times of the Roman raids into England, which resulted, finally, in the subjugation of the whole country, East Anglia played a not unimportant part. In fact, one of the largest Roman garrisons was at Camulodonum (the modern Colchester in Essex), where for well over 200 years, many of the famous legions were quartered. Excavations in the town of Colchester have revealed a vast quantity of evidence of the Roman occupation. The museum at this place contains a priceless collection of specimens of this period of English history.



Drawing by the Author

A PART OF EAST ANGLIA

Figure 1: "East Anglia" loosely designates an old Anglo-Saxon kingdom

Ipswich lies about 18 miles northward of Colchester and was connected with it by a well-made road which continued past the former town to the well-known Roman encampment of Caister near Norwich (Figure 1). Thus Ipswich was situated between two large centers of Roman activity and was not, in consequence, regarded in those days as a place of much importance. It is evident, however, that farming operations were carried on in many parts of the fertile land of eastern Suffolk, while it may be supposed that some of the high officials at Colchester had houses in the neighborhood which were used as headquarters for hunting expeditions. Some 30 or 40 years ago, during excavations at a place called Castle Hill, to the north of Ipswich and adjoining the Roman road running from Colchester to Caister, a large piece of decorated tessellated pavement was unearthed; and at a later time a great *amphora* or wine vessel, said at the time of its discovery to have been full of Roman coins.

DURING the past season, in order to find out more about the Castle Hill site, I undertook diggings there which have resulted in a series of discoveries which have thrown a revealing light upon the past history of this place (Figure 2).

Castle Hill, a significant name considering what has now been found there, occupies a commanding position from which in Roman times, before the town of Ipswich was built, splendid views must have been obtained down the beautiful estuary of the River Orwell; while to the southwest the road to Colchester, with its no doubt considerable traffic, would have been clearly observable. The excavations I have carried out have revealed two acres of tessellated pavement, which formed the floors of a room and a passage, respectively (Figure 3). These formed, evidently, the back portion of the house where the kitchens were situated; as nearby were found large numbers of animal bones, chiefly ox and pig, together with numerous oyster and snail shells, the remains of the ordinary Roman bill of fare.

The house was built upon a gently sloping hillside, and to accommodate itself to this the place was constructed at three different levels, communication to each floor being by steps. The building had, probably, a central courtyard, and was constructed in one story only. From the outside it must have resembled a modern bungalow in appearance, and was very well built, as is clear from the solidity of the remains of the walls which have been found, which after 16 centuries are still of an extraordinary hardness and strength. They were built of flint pebble, while the inside of the rooms were evidently decorated with colored plaster work in panels and having, chiefly, designs of foliage. Great quantities of fragments and pieces of this interior decoration have been recovered and the colors of the painting are still wonderfully clear and well preserved. With a floor composed of decorated pavement and the paneled walls, the villa at Castle Hill must have presented a very pleasing appearance, and have been an artistic and well built residence.

IN one of the rubbish pits examined, usually fruitful in finds, a bronze gold signet ring was discovered set with a nicolo stone upon which is engraved a seated figure. There were also found bronze dice and gaming counters, earrings, carved bone hair-pins, a colored

Courtesy Ipswich Museum

WHERE THE EXCAVATIONS ARE TAKING PLACE

Figure 2: The site is at Castle Hill near the city of Ipswich. The workman is standing upon the uncovered tessellated pavement. East Anglia abounds in archeological interest

glass medallion, bronze bracelets, and other objects in the same metal. Large numbers of pieces of broken pottery and roofing tiles were discovered, one of the latter still retaining the bronze nail with which it had been fastened. Some coins were also unearthed, and these are referable, as is the bulk of the pottery, to late Roman times.

A LITTLE to the south of the site of the villa were found two cooking vessels of large size (Figure 4) placed side by side with their mouths covered by Roman tiles. These had evidently been used as cinerary urns, as in them were discovered burnt human bones. It is unusual to come across evidence of cremation in the late Roman period, when inhumation was generally the practice. This was clearly shown by a find I made a little time ago of what was evidently the cemetery of the villa at Castle Hill. The place is about a quarter of a mile south eastward of the villa, and is situated on rising ground overlooking a small valley. Here were discovered upwards of 45 skeletons, in many cases buried with food vessels and other cultural objects (Figure 5). The bodies had been laid out full length with their feet pointing to the east, thus showing that the people were Christianized, but the presence of food vessels in the graves indicates that the old pagan ideas had not been completely eradicated

In the passageway of the villa already mentioned were found the remains of two small fires, which perhaps are of significance. When the Romans finally departed from England a very dark period of English history was inaugurated. In fact, we do not know exactly what did happen then, but it is probable that the times were very turbulent and invasions of East Anglia by people from across the North Sea frequent. It may be supposed that these people would camp in the abandoned buildings of the Romans, and not being accustomed to such places might be likely to light their fires in any room or passage which took their fancy. So the presence of charcoal in the passageway at Castle Hill may point to the occupation of the place by Anglo-Saxons who had invaded Suffolk.

The excavations of the Ipswich villa are to be continued, and there is little doubt that further interesting discoveries will be made. In the neighboring farmyard are several huge blocks of dressed stone of Roman date, which point to the existence at this spot of a large and important building. A small stone coffin of this period is also preserved at the farm, and this offers the prospect of unearthing the burial place of the owners of the villa, which by the poorness of the grave furniture in the cemetery already mentioned, is evidently not represented there.

Courtesy Ipswich Museum

PART OF THE FIND

Figure 3: View of a passageway of tesselated pavement in good condition

Courtesy Ipswich Museum

TWO CINERARY URNS

Figure 4: Originally these were cooking vessels which, like their later occupants, had become timeworn

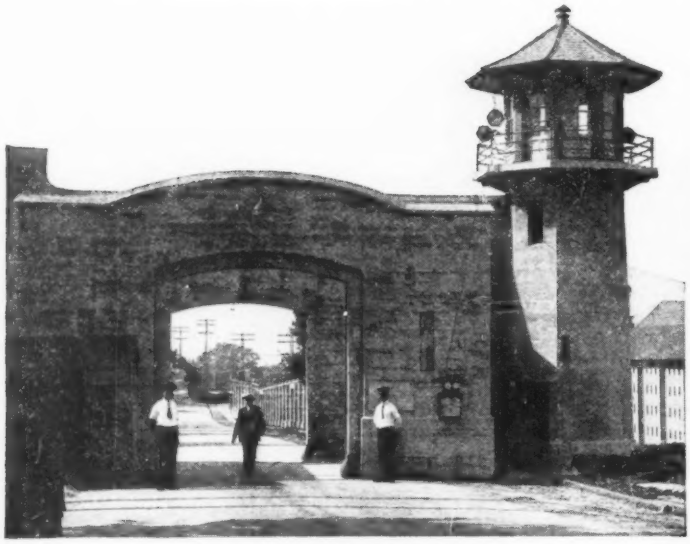
No signs of any fortifications have been found at Castle Hill, which fact points to the tranquility of the district under the Roman occupation, and to the complete subjugation of the native population. When, however, it is remembered that this villa was built after the Romans had been established in England for over 200 years, this state of affairs need cause no surprise. The invaders occupied the country for almost 400 years, and without doubt brought order and good government into what was, even with the comparatively advanced civilization of the Iron Age, a very backward country.

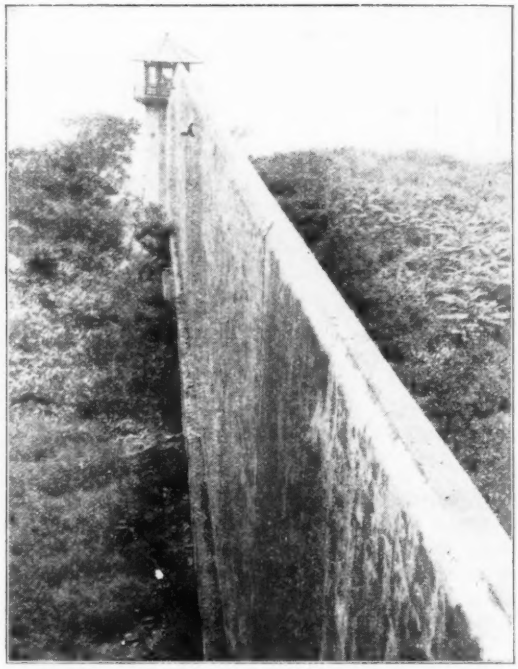
The Romans have left the signs of their occupation indelibly impressed upon England. Their wonderfully made and straight roads, the remains of their massive and handsome buildings, and the great walls they built in the north from one side of the country to the other, remind us of the colonizing skill and ability of this virile, tough-fibered race.

THE work being carried out at Castle Hill, Ipswich, is revealing yet one more intimate glimpse of the manner of life of the ancient Romans, and enabling us to realize how very "modern" was much of their civilization. Perhaps they suffered, as do many of the present day, from too much luxury in living, and it is evident that they used a prepared and cooked diet, because the teeth of most of the skeletons found possessed damaged and decayed teeth. Thus, at least 1600 years ago in England, the populace was suffering from the same dental ills which are so exercising the minds of those interested in the public health of today.

ROMAN SKELETON PARTLY UNCOVERED AT IPSWICH

Figure 5: In order not to damage the skeleton the work had to be performed with small hand trowels. It takes a considerable length of time and not a small amount of skill





PROTECTING SOCIETY ▲▶

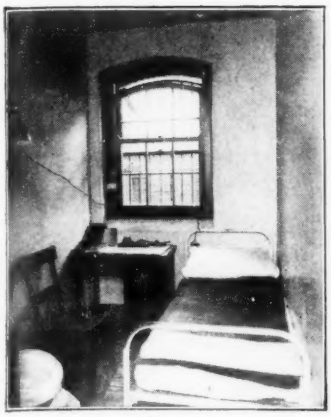
An entirely new entrance (above) forms part of the three quarter mile fence (right) which is 30 feet high. There are nine guard-towers manned day and night by armed guards. At night the wall is swept by searchlights on the towers. There are 70 acres in the enclosure. The new administration buildings on the left of the gateway shown above will house the warden's and other offices, reception rooms for prisoners, and visiting rooms

◀ **THE PRISONERS' GARDEN**

The prisoners like flowers and pets and here they are allowed to follow their bent; even a bird house is being built. The grim cell block a century old was condemned 60 years ago. Splendid new prisons on the hill at the right will soon make this inhuman prison a thing of the past—a relic to be banished from mind

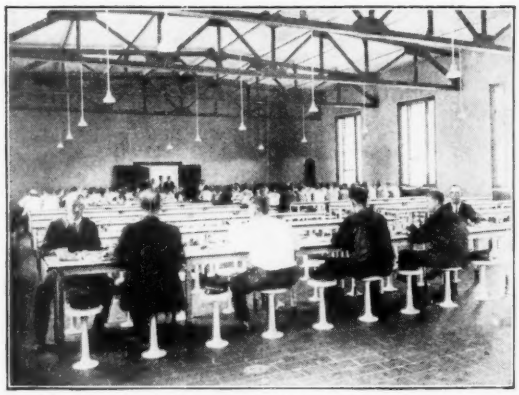
CELLS OLD AND NEW

To the left below we see some of the 935 cells in the 104 year old cell block. The cells are all stone, measuring about three by seven feet. The only ventilation is through the grilled top of the door; sanitary accommodations are a slop bucket. Here the men are locked up from dusk to 6:30. All heat comes from the corridor. The cells in the new prisons are shown on the right below. The cell doors are open grilles. There is a toilet, a wash basin, a bed, a chair, and even a desk in each cell



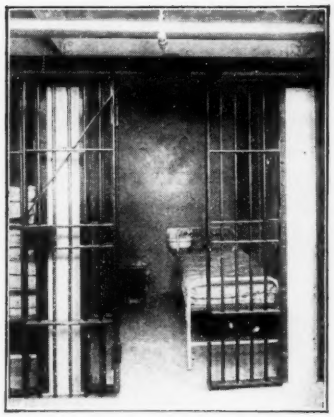
A BRIGHT CELL

Some of the new cells provide windows and comparative comfort



CLEANLY MESS HALL

A number of mess halls in the new prison supply coarse but adequate food. Twenty-one cents a day does not afford much opportunity for epicurean luxury



A HUMANE CELL

While not roomy, the cells are comfortable and above all, sanitary

Sing Sing Past and Present

Society Segregates and Educates the Anti-Social in the World's Most Famous Prison

THERE are 20 reasons for crime, according to Warden Lewis E. Lawes, of Sing Sing, but it is largely a matter of temptation, time, place, and circumstance. Although often mentally deficient and nearly always anti-social, criminals must be confined for the safety of the public. Shall we simply jail them until their time is up and they "get the gate" or shall we prepare them so that they will not continue to war against society? The warden believes that while the men must be safely confined, that a common sense understanding of the problem indicates a mean course between harshness and emotional pity. The prisoners know why they are there and what they want is a square deal, and nobody is as critical as a prisoner.

Certainly the physical condition of the jail warranted the expenditure of the 5,000,000 dollars which the new buildings have cost. Some of these prisons are now being occupied and in a short time the old cell house, a cruel and disgraceful structure built 104 years ago, will be a thing of the past, unless utilized for storage. The old cells are like tombs with ventilation only through the upper part of a door, and of toilet facilities there are none. The building was condemned 60 years ago; finally money was appropriated for a new prison. The new buildings are on high ground on a bluff overlooking the Hudson. The buildings are all connected and the prisoners can reach the shops along the Hudson by tunnels.

New prisoners are usually brought through a steel gate into the old prison where they are classified and subsequently measured by finger printing and the Bertillon system. They are then bathed and rigidly examined for drugs or dangerous instruments. The prisoner is given a number and he becomes a member of a community of about 1700 souls.

The first work is shovelling coal, but in time the principal keeper, the physician, the psychiatrist, the head teacher, and the director of industries have all had their chance to pass on the man. Why all this trouble? In the first place it is to help the prisoners from a humanitarian point of view and to return them to society better than when they went in.

The new death house, called the "condemned cells," is in a new 300,000 dollar building. The "chair" is a humane method of execution. The first shock is at a potential of 2000 volts. This is reduced to 500, then built up to 2000 again and the operation repeated until two minutes are up. Unconsciousness takes place in a 240th part of a second. The law requires an immediate autopsy.

LET us see how the prisoner's day is employed. The gong sounds at 6:00 A.M. and the men are checked up. At 6:30 they turn out of their cells. Breakfast is served at seven. At 7:50 the whistle blows, the men are counted again, and the day's work begins. At 12:00 o'clock the whistle blows and the men go to their respective mess halls for dinner. The day the writer visited the prison each man received cabbage, two slices of corned beef, two boiled potatoes, butter, and three slices of bread. Being the day before Thanksgiving, biscuits were added. The men pass in front of a steam table and receive their food. Coffee is served at the table. At 12:50 work is resumed after another count. Work ceases at 4:00 P.M., when a light supper is served. The allowance per man is 21 cents a day, so luxuries are absent. All "Grade A" prisoners may purchase food up to three dollars a week to supplement the prison fare. After supper the prisoners have a period of recreation and when dusk comes the men are counted and locked in their cells. There are often moving pictures to be seen. At 9:30 a final count is made and the lights are soon turned off and another day brings the prisoner nearer the "gate."

THE CHAIR OF DEATH

The execution chamber has a gripping interest. It is a part of a prison within a prison. "Condemned cells" are segregated

Courtesy Curtiss Aeroplane and Motor Company

FINANCE AND MANUFACTURE

The link between the manufacturing plant and the financial life of this country is one that is closely welded, and is typified by the view, at the left, of the floor of the New York Stock Exchange, in Wall Street, and the one above showing the interior of a large airplane factory where planes are being assembled

Investing in Aviation

The Recent Boom in the Aviation Industry Has Made it Doubly Necessary for the Prospective Investor to Investigate the Situation Thoroughly

By PROFESSOR ALEXANDER KLEMIN

In charge, Daniel Guggenheim School of Aeronautics, New York City, Corresponding Editor, SCIENTIFIC AMERICAN

PRIOR to the World War, American aviation was not at all on an industrial basis. It was considered a toy for the wealthy, or a hazardous undertaking best left to inventors and reckless young aviators. Almost the only contact that the public had with aviation was at exhibitions and meets, where the possibility of a fatal accident was one of the main attractions. And accidents, unfortunately, were quite frequent. Although the Wright brothers' first flight was made in 1903, fourteen years after, in 1917, the year of America's entry into the war, public prejudice still had to be broken down, and in spite of all efforts, aviation had not as yet been really popularized.

WHEN the United States did enter into the war, the Army and Navy Joint Technical Advisory Board recommended first the immediate manufacture of 3000 airplanes. The airplane losses of the allies were so high, however, that not 3000, but 20,000 airplanes were needed. Under the general direction of the Aircraft Production Board, the aircraft industry undertook an immense and hurried expansion which, on the whole, was highly creditable. Had the war lasted another year, thousands of war planes and Liberty motors would have been shipped to Europe each month.

At the close of the war in 1918, the aircraft industry employed 27,000 workers with a reported production capacity of 21,000 planes a year. With the signing of the armistice, the aircraft industry paid the penalty of being purely a military adjunct. Invested capital was withdrawn, engineering talent was scattered, and machinery was scrapped.

THE great industrial development of the United States has in recent years been attended by spectacular rises in the values of stocks in such industries as oil, automobiles, rubber, and radio. Both financial authorities and the general public seem now to be convinced that aviation is the next field of great industrial expansion. Eager inquiries are made of men engaged in the aviation industry as to possibilities of investment therein. In view of the widespread and somewhat excited interest in aviation, it is not out of place to analyze the general situation as dispassionately as possible, and point out some of the possibilities which might be overlooked by the layman.

Manufacture for the government was reduced to a minimum and a huge amount of war material was thrown on the market, thus obviating the production of commercial aircraft. Civil flying activities were reduced to the operation of the "gypsy flyers," young aviators who purchased cheap war planes and earned a precarious living carrying passengers, or "barnstorming;" that is, traveling from place to place giving exhibitions. For three or four years the industry was at its lowest ebb.

IT is interesting to record the various events which transformed this dismal situation to the present brilliant one. In 1918, the United States Post Office Department established an experimental air line between New York and Washington. While this was soon abandoned, the air-mail service developed the air line between New York and San Francisco division by division. Night flying, over lighted airways, was also persistently and skillfully developed. On July 1, 1924, the transcontinental service was established, and attracted such patronage with its 36-hour service, that by July 1, 1925, the air mail had flown 9,839,000 miles and carried 261,987,120 letters.

These successful operations led Con-

gress to pass the Act of February 2, 1925, authorizing the Post Office Department to contract for the private operation of existing routes, and for the establishment of new routes, also privately operated. By September 1, 1927, the Government had withdrawn from all air-line operation. Not only Congress, but the aircraft industry itself, had been steadily opposed to all forms of subsidies. The rapid and successful development of private air lines has fully justified this policy.

Then there came the Air Commerce Act of May 20, 1926, which called for the appointment of an Assistant Secretary for Aeronautics in the Department of Commerce, with duties calling for the regulation of air traffic and the licensing of pilots and aircraft. Under this act, Congress appropriated 300,000 dollars for "Aids to Navigation"—the installation of beacons and lighted emergency landing fields along existing contract air-mail routes.

Next, the Navy Five-Year Aircraft Program Act, approved on June 24, 1926, allowed for the construction of 1614 airplanes, and an expenditure of 85,078,750 dollars during a five-year period. The Army Five-Year Act, July 2, 1926, provided for a great increase in the Army Air Corps personnel and for obtaining 1600 serviceable airplanes.

These two acts provided a tremendous stimulus to the aircraft manufacturing industry. The Air Commerce Act was calculated to raise the confidence of the public in the safety of flying, and of financial interests in the stability of commercial aviation. Together with the Kelly Bill, authorizing the private operation of air-mail routes, it rapidly stimulated the growth of air transport.

THE year 1926 would have been a banner one for American aviation with no other happy events. But there were yet other aids to advancement of the industry. Henry Ford entered the field as an aircraft builder and operator, creating a decided impression on both public and capital. The National Air Transport Corporation was formed with a Board of Directors composed of some of the most prominent men in American finance, business, and industry.

In the meantime, planes and engines had been steadily improving in speed and reliability. Many important adjuncts such as lighting equipment and radio beacons had reached a high degree of usefulness. Many of the "gypsy fliers" had vanished from aviation in the lean years of the industry. Others had settled down as fixed base operators. A branch of aviation, distinctively American in character had arisen, under the name of Aerial Service.

Aerial service is a collective term which includes aerial taxi work, crop dusting, photography and survey by air, flying instruction, forest fire patrol, and a dozen other activities. In no European country has it reached anything like the proportions attained in the United States.

The year 1927 was clearly showing the benefits of all these governmental, engineering, and commercial influences when there came the historic flights of Lindbergh, of Chamberlin and Levine, and of Commander Byrd and his associates. Lindbergh's flight in particular was the spark that aroused universal enthusiasm and interest in aviation.

The progress of American Aviation since Lindberg's flight has been breathtaking and apparently it is at the time of writing marching forward as rapidly as ever.

It is interesting to consider some statistics of airplane production. According to data collected by the Bureau of the Census, production since the war has been:

Year	Total number of planes built	Total Value —Dollars
1919...	662	
1921...	302	
1923...	587	
1925...	789	6,673,659
1926...	1186	8,871,027
1927...	1962	14,512,999

These figures show a remarkable increase for 1927. Moreover, the Bureau of the Census figures may not be complete. So many airplane factories are engaged in building planes that competent authorities consider the number of planes built in 1927 as being closer to 3000.

The figures for 1928 will, in all probability, be much larger when they are finally tabulated. All the factories in regular commercial production during 1927, announce larger production for 1928. With some, the production is to be doubled or even tripled. A plane a day no longer strikes the airplane builder as an extraordinary output. One factory announced an output of 25 machines a week during 1928.

SOME enthusiastic observers predict that the complete figures will show an output of 15,000 planes for 1928. This number is probably too optimistic, but it is quite reasonable to expect the construction of 4000 planes with a value of between 20,000,000 and 25,000,000 dollars.

Production methods have kept pace with increased production. In the early stages of aircraft construction, every part of the airplane was built painfully by hand. Metal fittings were cut slowly out of flat stock. Wooden ribs were built by cutting out strips of wood of various sizes and by glueing small pieces of wood and plywood together. Fuselages were built with a complicated fitting at every joint. Now duralumin ribs may be stamped out in a single operation. Hand-made fittings are replaced by stampings, forgings, or castings. Particularly in the construction of fuselages, fittings are avoided altogether by the use of welded joints.

Sales have kept pace with produc-

THE SKY IN THE FUTURE?

This is an actual, unretouched photograph of a mammoth army demonstration of aerial maneuvers presented recently at San Diego, California. Will such scenes soon be common?

tion. It is not uncommon for a manufacturer to state that he cannot make deliveries under ninety days. All the principal manufacturers have unfilled orders on their books. Instances are related where responsible business men have visited plants and produced certified checks for 100,000 dollars in a vain endeavor to secure early deliveries on planes.

The increased safety of the airplane and the great increase in the number of landing fields lead many sportsmen and other well-to-do men to think of private ownership, for pleasure, and sometimes for commuting purposes over long distances.

Young America wants to follow in the footsteps of Lindbergh. Flying schools all over the country are besieged with applicants. As soon as a young man has learned to fly, he wants to have his own plane. The tendency for young people to own planes for pleasure or sport is being encouraged by the formation of flying schools and flying clubs throughout the country.

Large business houses have become aware of the possibilities of the airplane in sales work, in emergency distribution of parts, and in trips of inspection by executives. At least forty business houses now own planes for business purposes and this number is increasing rapidly. The airplane can be used by doctors in sparsely populated districts, and by ranchers, prospectors, surveyors, and men in many other occupations.

THE steady extension of aerial service of various types also means an increase in the purchase of airplane equipment. The rapid, nation-wide extension of air transport means more outlets for the sale of passenger and mail planes. Therefore, it can be predicted without much hazard, that there will be both a steady and a rapid increase in the sale of airplanes for all purposes.

The possibility of increase in the number of planes sold has been fully realized by every one connected with aviation and has led not only to greatly increased production by established manufacturers but also to the incorporation of many new companies. There are at the present moment more than one hundred and fifty plane manufacturers in the United States and new producing companies are announced almost daily.

The automobile is severely restricted as to general dimensions and design, but the airplane can be a monoplane, a biplane, or a triplane. It can be a "flivver" plane of twenty-foot span, or a giant seaplane of one hundred and fifty-foot wing spread. Therefore it is improbable that the airplane will ever be as standardized as the automobile. But it is susceptible of greater standardization than, for example, water craft. From a standardization and concentration point of view, airplane manufacture should, therefore, lie somewhere between the automobile and power-driven water craft. With greater diversity of types, there is perhaps room for more plane factories than for automobile factories.

Nevertheless, it is a significant fact that there were once upon a time some two hundred automobile factories, and that out of these less than twenty remain to-day and that, while enormous fortunes have been made out of the automobile, there have been as many

failures, drastic re-organizations, and unpleasant receiverships.

In aviation, there is a similar mushroom growth of builders, a good portion of whom will disappear, as time goes on, under the pressure of competition, consolidation, and other powerful factors. Some of the factories, on the other hand, will undoubtedly eventually reap success and huge profits.

The first class of manufacturer to be considered is that of the factory producing exclusively for the Army and Navy air services. It is an open secret that many such manufacturers have made comparatively large fortunes. The number of government contractors is not permitted to increase. The five-year army and navy programs give them assurance of continued, steady business for some years to come.

SUCH factories are, as a rule, privately owned, and are now responsible, well conducted concerns. If an investor finds an opportunity to buy into such an organization, with a well-established record of earnings and friendly relationships with the government, he may rely on a steady and large return on his investment. The possibility of the investment becoming a splendid speculation, however, with capital multiplied many times, is not so promising. Such factories have become more or less stabilized and, since they are exclusively engaged in government business, expansion of their business is necessarily limited.

The factories which may be considered to be in the strongest position of all are those which, while having a secure hold on government business, have also found it possible to undertake the construction of commercial planes. Their government business should keep them steadily employed, no matter what the state of the market may be. Their commercial plane business gives them the opportunity for indefinite expansion.

Only one such airplane company is listed on the New York Stock Exchange. The price of its stock is at present perhaps too high, partly due to the speculative boom, and partly to the general public's enthusiasm for aviation. At the first real depression in price, it should be an excellent purchase for a long term investment.

There may be some real bargains in the stock of recognized airplane factories having this double foothold, which have not yet given proof of earning power. They will be in a position to take advantage of any further growth in the airplane market, and because they are not earning as yet, there may be all the more reason for the purchase of their low-priced stock by investors who do not need immediate dividends.

Then come the companies which are engaged in the building of purely commercial airplanes. Some of these, in existence for several years, started in a humble manner, and have grown to large proportions. These factories are mostly to be found in the middle west. They took advantage of the sale of large numbers of OX-5 engines, which the government threw on the market at prices as low as 50 dollars each, and built small two-seater or three-seater machines at a price under 2500 dollars. As a result of this policy, they achieved large sales and efficient production. These companies operate with small executive and engineering staffs, and are worth careful consideration.

THE OX-5 engine of 90 horsepower is disappearing. It will have to be replaced by air-cooled engines of similar power or greater power at a price of between 2000 and 3000 dollars instead of an average of 200 dollars each for the OX-5 type. The prices of planes will have to go up to meet this situation. If the manufacturers of low-price planes can overcome this handicap by forced price increase, they will undoubtedly have a brilliant future before them.

So far we have been discussing classes of plane builders whose stock the general public has found difficult to obtain. The companies whose stock is readily available to the public, or is even thrust upon the public, are the new companies recently formed or now in process of formation. There is a serious danger that the public may lose large sums of money by investing recklessly in such companies.

There is, to begin with, already a sufficiency of plane builders. The

success of the mid-west manufacturers was predicated on the availability of the cheap OX-5 engine, which can no longer be counted upon, and on the fact that when they started out, they had little or no competition to meet. To-day, competition is keen.

A new company should have a first class engineering staff. The mid-west manufacturers did not, in their engineering work, have to meet the rigid requirements of the Department of Commerce regarding drawings, stress analysis, et cetera. While these requirements are conducive to safety, they also increase cost. Keener competition and continual improvement in design also make further demands on engineering skill. A good pilot, or a first-rate airplane mechanic does not necessarily make a good plane designer.

To build a new airplane, even though it be of a purely conventional type, always costs more money than the enthusiastic designer or promoter anticipates. Even with the most skilled design, there are always chances of error, chances of accidents, or damages on the first trial flights. The time required to build the first machine always exceeds first estimates.

Three or four years ago, it was possible to build five or ten small machines; and to sell them informally through friendly pilots, without much capital outlay. Now it is necessary to begin with sufficient capital and organization to build a large number of planes at once, in order to meet competitive prices. If the formation of a new company is to be justified, it must be dependent on a number of such factors as the availability of a designer of real skill and reputation, backed by men experienced in plane production; adequate capital; adequate plant facilities; the possibility of selecting a type of plane that will not have to encounter too great a competition; or the possibility of building a new type of outstanding excellence.

THE only justification for starting with small resources lies in the possibility of "custom" trade such as the building of air yachts for very wealthy men who are willing to pay as construction proceeds, and to pay more than current market prices. A design of quite exceptional merit may be another such justification, but such designs are very rare.

There is not the slightest doubt that plane manufacture offers great opportunities for investment, but such investment requires consideration.

The Airway Map of the United States issued by the Department of Commerce shows the extraordinary growth of the air-mail services since the establishment in 1918 of the first short line between New York and Washington. The Post Office Department is continually asking for bids on new air-mail services and such airway maps are out of date before they are published. The growth of the service is so rapid that statistical surveys also lag far behind the progress made. It is probably best, therefore, to restrict our brief review up to the end of 1927.

First of all, we have a striking chart, prepared by the Aeronautical Chamber of Commerce, of the airplane-miles flown in transport operations on regular schedules in the leading countries of the world. It is at once evident from this that the United States already leads in regular flying mileage, and that the rate of growth is the most rapid in this country. Furthermore, in Europe the air lines have already taken such an extension that their future growth is limited. In the United States the ground has just been scratched.

REFERRING now to the Aircraft Year Book published by the Aeronautical Chamber of Commerce, we find that on or about January 1, 1928, the number of air-mail routes was already 22, all privately operated. The aggregate length of the routes was 11,446 miles.

The total flying scheduled over the 11,446 miles of routes in operation and authorized at the close of 1927 for 1928 exceeded 8,000,000 miles per year. Compared with the 4,128,029 miles scheduled for 1927, the tremendous growth is again emphasized.

Courtesy Ireland Aircraft, Inc.

The aggregate volume of mail carried in the United States in 1927 was 1,485,250 pounds or the equivalent of 59,411,200 letters. Of this, private air mail lines flew 3,823,214 miles and carried 1,001,414 pounds of mail.

On August 1, 1928, a new air-mail rate became effective—five cents for the first ounce, ten cents for each additional ounce or fraction of an ounce. There is not the slightest doubt that this will stimulate the growth of air mail to a tremendous extent, and that the problem of the air-mail operator in loading his plane to capacity will disappear.

An investigation made by the Chamber of Commerce of the United States indicates that chambers of commerce all over the United States are building or encouraging the construction of airports and urging Washington to carry the air-mail service to all centers not served by it heretofore. The chambers of commerce are also using every possible method to stimulate the use of air mail, by such means as personal letters to potential users of air mail, interviews with large users of air mail to discover benefits based on experience, guarantees of a certain amount of air mail per month, et cetera.

The United States Chamber of Commerce has also made an inquiry into the kind of goods sent by air. It is interesting to quote from some of the reports received by this organization:

LOS ANGELES CHAMBER OF COMMERCE

"Limited parcel post service comprizes such articles as motion picture films, flowers, automobile supplies, medical supplies, and various articles from department stores, including ready-to-wear clothing, optical goods, et cetera."

MERCHANTS ASSOCIATION OF NEW YORK

"Millinery, machine parts, special dyes, surgical instruments, jewelry, fish, et cetera."

OKLAHOMA CITY CHAMBER OF COMMERCE

"Articles being sent by air mail from this point include automobile parts, oil field supplies, and almost all classes of merchandise."

IT is a curious fact that in the carrying of passengers by air the United States has lagged behind Europe. This is explainable on a variety of grounds. Very favorable geographic conditions exist on certain European air lines, as for example on the London to Paris routes, where two and a half hours flying is the alternative to eight hours ordinary travel with two changes of conveyance, and a nasty channel crossing in between. In general, air travel in Europe is much more convenient than sleeper travel. It is due further to the greater airmindedness of the European, whom persistent aerial warfare for four years and the use of the airplane for communication between capitals and army fronts has thoroughly educated to the use of the airplane.

Passenger-carrying is, perhaps, less profitable than mail service. In Europe, subsidies for passenger travel have made it a matter of indifference to European companies whether they carried mail or passengers. In Europe, and particularly in Germany, traveling by air is regarded as a patriotic duty for all citizens.

In the United States, the excellency of railway communication makes short hauls by air impracticable. Flying between such centers as New York

and Chicago does not mean a saving of time. Eight hours of daylight flying mean far more loss of time than a sleeper ride on the *Twentieth Century Limited*, and aircraft operators are still reluctant to carry passengers by night.

Whatever the reasons, air transport operators were reluctant, until recently, to enter the passenger field. Since Lindbergh's flight, the public has been bringing pressure to bear on the operators and in 1927 well over 8000 passengers were carried in regular air transport. The approximate figures for some of the air lines are as follows:—

Western Air Express, between Los Angeles and Salt Lake City—400 passengers.

Boeing Air Transport, between San Francisco and Chicago—525 passengers.

National Air Transport, between Chicago and Dallas—168 passengers.

Colonial Air Transport, between Boston and New York—509 passengers.

Pacific Air Transport, between Seattle and Los Angeles—1252 passengers.

Maddux Air Line, between Los Angeles and San Diego—1400 passengers.

Pacific Marine Airways, between Los Angeles and Catalina Island—4200 passengers.

Stout Air Service, in and out of Detroit—1287 passengers.

Courtesy Advance Aircraft Company

PERHAPS the most promising recent event from the point of view of air-passenger traffic is the formation of the 5,000,000 dollar Transcontinental Air Transport, Inc., with the National Air Transport, as associated air operators, with the Pennsylvania, the Atchison, Topeka, and Kansas, and the Santa Fe railroads co-operating, and with a Board of Directors composed of eminent leaders in aviation, finance, and railway work. A 48 to 52 hour schedule across the continent, with night travel by train, and day flying across the most promising country, topographically speaking, gives the best promise of safety.

Very important and encouraging also is the pronouncement of General Atterbury, President of the Pennsylvania Railroad, that the railways must not repeat the mistake they made in bus transportation but must make full use of the airplane.

THERE are many problems still to be solved in the safety and comfort of passenger gravel. But it may be concluded without undue optimism that American air passenger travel is now assured of success, and will soon constitute an important source of revenue for the operator of an air transport line.

Enthusiastic promotors of air transport companies and sometimes even well established corporations are apt to under-estimate the expenses of operation. The obvious items of expenditure are gasoline, oil, and pilot's pay. But even with the aids to navigation such as lighting, radio beacons, and weather service supplied by the government, the items of expenditures are many and onerous.

The following list of items in the estimate of costs of a proposed air line, similar to that given in the Civil Aviation report, shows that a good deal more than the cost of planes, gasoline, oil, and pilot's pay has to be taken into account.

CAPITALIZATION
- Airplanes without engines
- Engines
- Special accessories, such as radio, telephones, and parachutes
- Office equipment
- Hangars and their equipment
- Machinery, tools, et cetera
- Supplies and material
- Motor transport
- Operating capital

ANNUAL OPERATING EXPENSES
- Salaries for pilots, mechanics, superintendents, and other operating personnel
- Pilot's mileage
- Gas and oil
- Maintenance and repair
- Telephone and telegraph
- Freight and express
- Motor transportation
- Mileage and expenses of personnel traveling otherwise than by air
- Insurance
- Administrative overhead
- Advertising
- Traffic solicitation
- Miscellaneous

DEPRECIATION
- Airplanes
- Engines
- Other equipment

In scrutinizing estimates of costs, it should be particularly remembered that depreciation and obsolescence for aircraft equipment are still very heavy, and that an annual depreciation of $33\frac{1}{3}$ percent for both planes and engines is none too high. Aircraft insurance also stands at quite a high figure as yet, and adds an important item to the annual expenses.

Detailed estimates of operating costs are not yet generally available. American operators still regard such information as confidential. Therefore Post Office Department cost reports are highly valuable, even though governmental methods of accountancy are not directly applicable to private operation.

THE following is the United States Air Mail financial report for the fiscal year July 1, 1924 to June 30, 1925.

In 1927, the cost per mile of the United States Air Mail had sunk to 0.502 dollars. In 1927 the cost per mile of an important group of private operators averaged 0.671 dollars. Such cost estimates are probably still somewhat unreliable, and will remain so until definite methods of accountancy have fully developed in this new field. Still there seems no reason why operation with single engined planes should not sink to 50 or 60 cents per mile, particularly as operating experience grows.

The greatest source of revenue for the air transport operator has so far

been in mail. The operators actually make their bids to the Post Office Department on a basis of so much a pound of mail, at prices varying on different routes from something under a dollar, to the permissible maxium of three dollars a pound.

Even with keen competition on bids, if the operators managed to secure enough mail to load their planes to capacity, they would be on the way to making very large profits. But during the month of May, 1928, they managed to carry only an average of 176 pounds per trip.

Nevertheless, for the period from January to June, 1927, the mail revenue per mile of these operators was 58.4 cents. For the period from July to December, it was 76.9 cents. With the increase in air mail which the five-cent postage will bring, the problem of bringing revenue well above expenditures should be fairly well solved. It is understood that eight air lines showed substantial profits in 1928, although others showed losses. Freight and passenger work will undoubtedly help the air transport operator more and more.

THERE does not seem to be much doubt that air transport is now a sound industry. Investors must still expect a long persistent effort before final success is attained. But ultimately they may expect large rewards.

The only warning to sound is that the prosperity of some of these companies and the brilliant prospects ahead will bring into being many companies without experienced administrative and operating personnel, who will be unduly optimistic in their cost and revenue estimates, who will bid too low on government contracts, and generally court disaster.

In the field of aircraft engine construction, there are three or four companies which have established a solid business with government departments. While there is keen competition for government work, it may safety be said that such companies will continue to receive government orders steadily. The possibility of great expansion rests, however, with those companies which are building commercial engines.

The position of a company such as the Wright Aeronautical Corporation, with a firm footing in both the government and the commercial field and with large resources at its command, can be judged on a basis similar to that of any other well-established concern. Its securities are listed on the New York Stock Exchange. Its balance sheets are available. Its earnings do not seem to be high enough to justify the present level of prices, but there is every prospect that such a company will share to the full in the expansion of business, and that its securities are speculative but sound for the long investment pull.

It is when investing in newly-organized companies, building or about to build engines of between 50 and 150 horsepower, that the greatest caution must be exercised. Investors should bear the following facts in mind:

There are some 15 or 16 such companies already in the field.

While the OX-5 engine is disappearing, and builders of planes are preparing to pay as much as 2500 dollars to 2700 dollars for engines of 110 to 135 horsepower, price competition is going to be extremely keen.

No engine, however skilfully designed, can be considered a commercial product until it has passed a government test, and until it has shown reliability and endurance under actual flight conditions. The most surprising defects may show up in practice. An engine is far more difficult to bring to a point of practicability than the rest of the plane.

The equipment needed for the production of the refined aircraft engine is both varied and expensive.

Successful engine construction requires a basically larger investment than successful plane construction.

Service on engines is far more of a problem than plane service. An engine company with a perfect product, may fail completely in maintaining its sales, if it is unable to give adequate service.

The commercial aircraft engine situation is almost chaotic. Investment in commercial engine companies is highly speculative at the moment, although it offers a chance of large profits to those who survive the long pull.

The investment trust has long flourished in Great Britain and is now taking solid root in the United States. Broadly speaking, an investment trust is an organization which makes a careful study of an industry and purchases the shares of many companies in a given industrial field. It offers to the investor a diversified investment, and a high degree of skill in purchase and analysis.

It is extremely gratifying to note that three such investment trusts have recently been formed to invest in aviation securities.

One is Aeronautical Industries, with Lester D. Gardner, former publisher of *Aviation* as its president and with a board composed of bankers, business men, and technicians well versed in aeronautics, but not so closely associated with specific aviation industries as to have their judgment warped. We quote their statement:

> "Aeronautical Industries proposes to furnish the pioneer fund for the expansion of aviation, to explore the entire field of aeronautical investment; to maintain contact with the growth of the aeronautical industry, and through diversification secure for its stockholders the maximum of safety."

The second is the National Aviation Corporation with J. C. Willson as President. The announcement of this group reads:

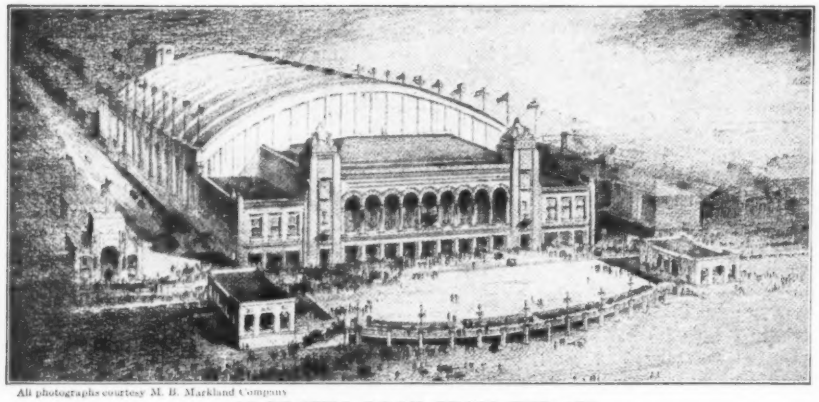
> "About 25 percent of this group represents leading manufacturers in this trade; others are engaged in transport, either of mail, goods, or passengers. This group has come together for the purpose of using the funds of the company profitably by participating in the business of established concerns and by helping to finance new companies as they are organized."

The third and most recently formed organization is Air Investors, whose policy appears to be similar to that of the National Aviation Corporation.

Either corporation may well deserve consideration at the hands of an investor interested in aviation who is convinced of its great possibilities yet is somewhat perplexed by the complex position of the industry.

Our conclusion is that aviation is an industry in which many difficult problems are still to be met, in which many "wild cat" promotions will cause the public to suffer, and in which selection is very difficult. It is, nevertheless, fundamentally sound and has prospects of tremendous expansion, such as no other industry can offer at this time.

CIVIL aviation has progressed to a point where the discussion of the type of plane to buy rivals in interest similar discussions on the merits of various motor cars. With this in mind, Professor Klemin, author of the above article, has prepared a comprehensive survey of the private plane field. This will be presented in March, our special Aviation Number.



All photographs courtesy M. B. Markland Company

AS IT WILL LOOK FROM THE AIR

The architect's drawing of the building which is to be known as the Atlantic City Convention Hall. In exterior design, it is a beautiful adaptation of the Romanesque period

World's Largest Hall Seats 40,000 People

Massive Structure Beside the Famous Boardwalk in Atlantic City, New Jersey, Built to Take Care of Huge Conventions

WHEN the general building contractors turn over to the city commissioners of Atlantic City, New Jersey, the gigantic convention hall which has been in course of construction since August, 1926, the United States may again claim another "world's largest" structure. The building, which covers an immense plot 350 feet wide by 650 feet deep, and which will have a total seating capacity of 40,000, will be completely finished about February 1st. The municipality that has built this structure has a population of only 65,000, but the building's particular significance will be appreciated when it is recalled that during special occasions in the summer season there are from 350,000 to 400,000 visitors on the famous boardwalk at one time. Several large associations have already planned to hold conventions in the new hall.

The Atlantic City convention hall is located on the boardwalk directly facing the ocean and between Georgia and Mississippi Avenues. The Pennsylvania Railroad has a terminus on Georgia Avenue and the Philadelphia and Reading Railroad has one on Mississippi Avenue. The building is therefore most conveniently located for visitors and convention delegates.

The excavation for the substructure, or basement, entailed the removal of some 365,000 cubic yards of sand, and due to the loose nature of this foundation material and the fact that seepage of water from the ocean was expected, 12,000 wood piles, each 30 feet long, were jetted into place with a water jet at 60 pounds pressure, and after setting were tapped with a steam hammer. The basement, when completed, was water-tight.

THE area of the main auditorium floor is 168,000 square feet with an additional space of 100,000 square feet on the ground floor. The main auditorium has a seating capacity of 25,500 on the floor and stage and 9500 in the balcony and committee rooms. The main auditorium is large enough for all kinds of industrial exhibitions and conventions, athletic games, and indoor circuses.

In addition to the main auditorium there is a large hall 130 feet by 185 feet on the boardwalk in front of the building, which may be used for smaller conventions, art exhibits, banquets, and dancing. This hall will have a seating capacity of 5000 people,

FOUNDATIONS IN THE SAND

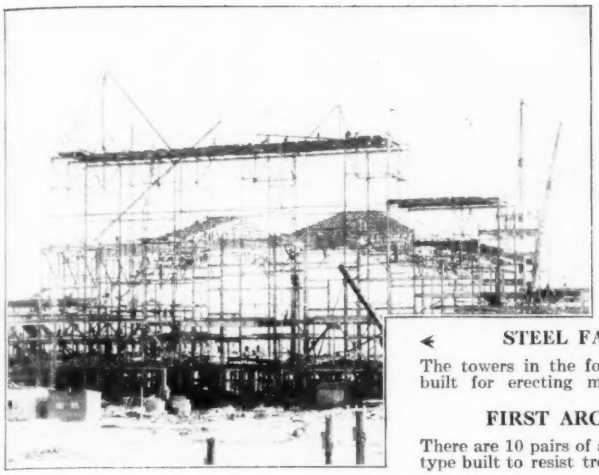
Preparing forms for beams and girders which were anchored to foundations to resist the upward thrust

THE HUGE BASEMENT

The basement floor and all interior walls were thoroughly waterproofed due to the fact that the basement is below tide level

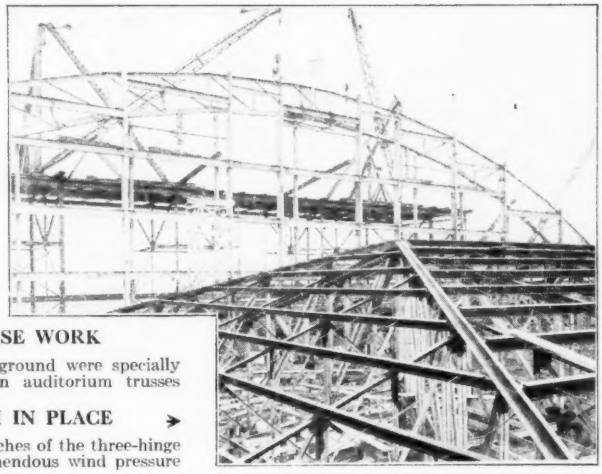
THE WORK PROGRESSES

Foundations with reinforcing steel looped to anchor floor system. The piles, which resist a lift of 10 tons each, project into the concrete



← **STEEL FALSE WORK**

The towers in the foreground were specially built for erecting main auditorium trusses



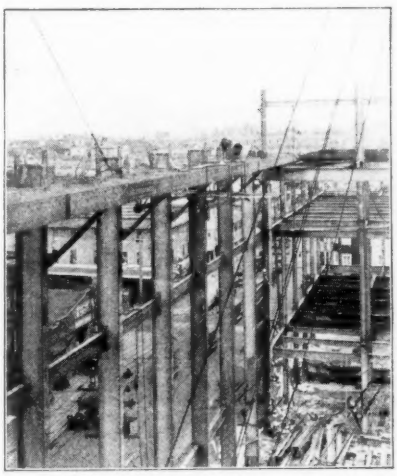
FIRST ARCH IN PLACE →

There are 10 pairs of arches of the three-hinge type built to resist tremendous wind pressure

and will include a stage and committee rooms. Fronting the length of this room is a large arched loggia 12 feet wide looking out on the ocean.

On the boardwalk, an arcade about 12 feet wide has been arranged across the face of the building. Along this passage are located 14 shops faced with marble and ornamental bronze, with a large ornamental entrance to the hall, located in the center. Other stores face Pacific Avenue.

THE entrance lobby has a vaulted passage 50 feet wide and about 125 feet long. The walls are of limestone with a ceiling of Gustavino tile and two-tone terrazzo floor with appropriate bronze enframements around the windows, thus giving it a dignified monumental character. Corridors lead from this lobby and connect directly with ramps which lead to the upper and lower levels of the auditorium. Space has been provided on the ground floor to accomodate 400 automobiles. On both Georgia and Mississippi Avenues, terraced sidewalks have been provided in addition to ramp inclines from the ground so that enormous crowds can be handled expeditiously. The building is fireproof throughout.



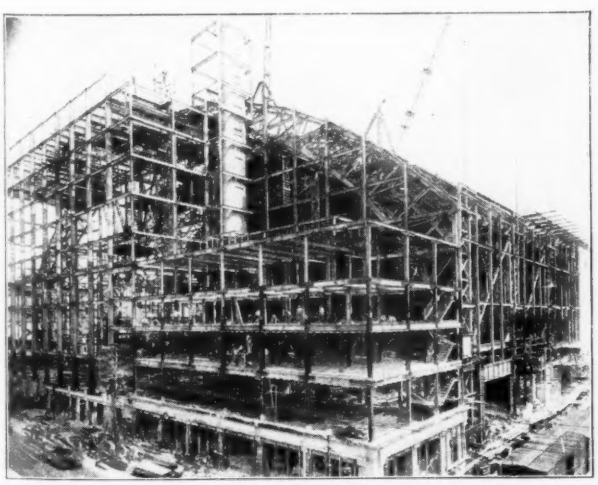
46-TON PLATE GIRDER

This girder was installed to take care of wind pressure against wall in rear of stage

To support the main roof of the auditorium 10 pairs of three-hinged trusses, weighing 220 tons per pair and spaced 49 feet apart, have been provided. These trusses have a clear span of 350 feet and are 130 feet high from the main auditorium floor to the under side of the trusses. These are said to be the largest ever erected in a building of a permanent nature. These trusses and the ceiling are covered with material decorated in a pattern and design of dignified simplicity. Incidentally, the truss ties are built into, and form a part of, the main auditorium floor, a feature which allows all framing attached thereto to move slightly under heavy wind loads and temperature changes.

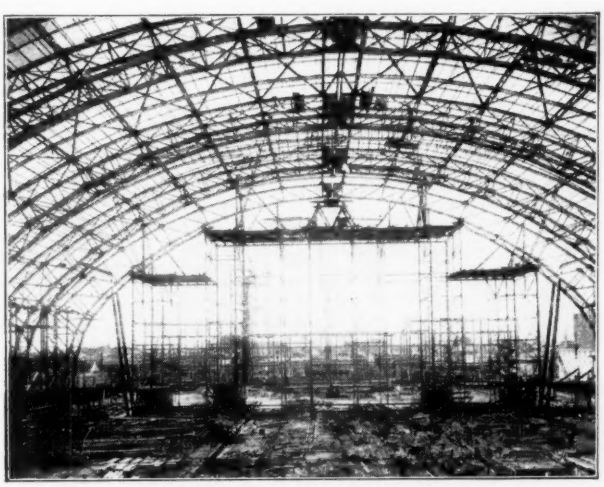
AS is necessary in a hall of this size, careful consideration had to be given to acoustic qualities and a special treatment has been provided whereby with the aid of amplifiers and reproducers, speakers may be heard in all parts of the great auditorium.

The heating and ventilating re-



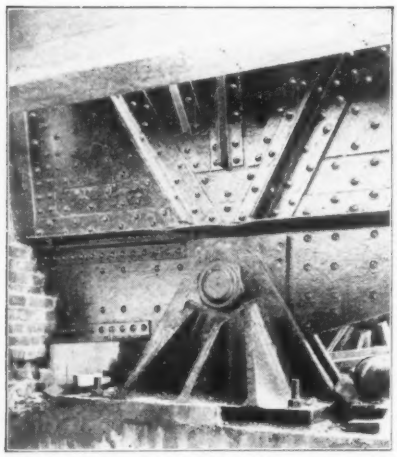
ALL THE STEEL IN PLACE

Steel frame from the stage end of the main auditorium. After second truss was in place, the general contractor erected others



BENEATH THE TRUSSES

The truss-supporting "false work" towers can be seen plainly. The center pin of the three-hinged trusses will also be noted



BASE BOLTED TO FOUNDATIONS

The base on one side is rigid and on the other side is set on a rocker nest of rollers

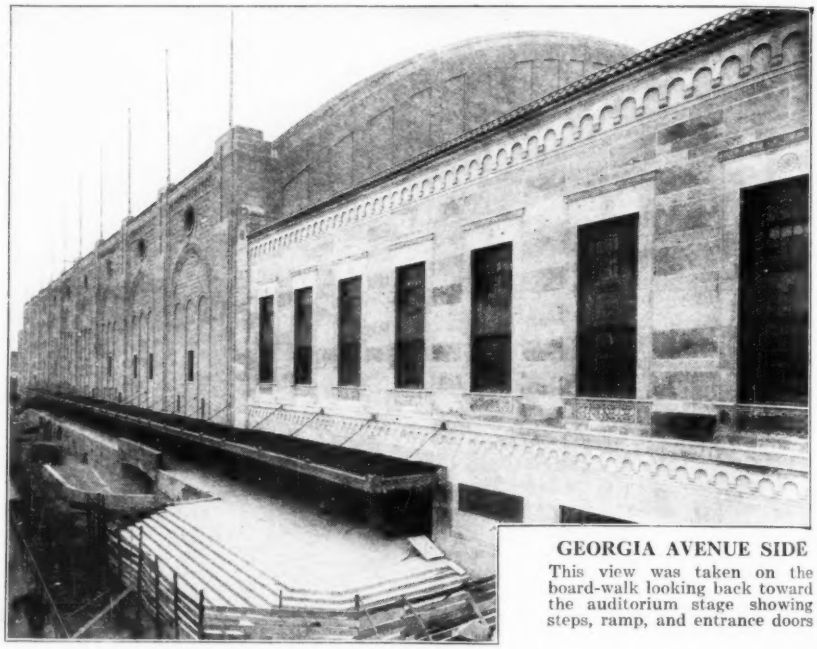
quirements for the auditorium are unusual due to the size of the building. The main hall and ball-room are heated principally by the air which is used for ventilation, provisions being made for re-circulation. Direct radiation is used in the main entrance lobby and entrances on the sides of the building, and is supplied by re-circulating air warming units. Stores, offices, corridors, stairways, et cetera, are served by direct radiation. Six vacuum pumps are provided for maintaining the required vacuum in the heating returns and for the disposal of air and condensation. Automatic control is provided to regulate temperature throughout the building.

Thirty-one motor-driven fans with a capacity of 1600 tons of air per hour are provided for ventilation. Seventy-five vent fans, capable of discharging 2900 tons of air per hour, are distributed throughout the building. Of the air supplied to the building, 72 percent is for the main hall.

Due to the fact that the building is to be used not only for conventions of various kinds, but also for machinery exhibitions, it was necessary to install elevators capable of handling various types of heavy equipment. Also since one end of the building is almost entirely devoted to the stage and its various dressing rooms, it was necessary to provide several elevators to handle the huge numbers of chairs and the stage scenery. After making a careful analysis, Otis elevators were selected to be installed throughout.

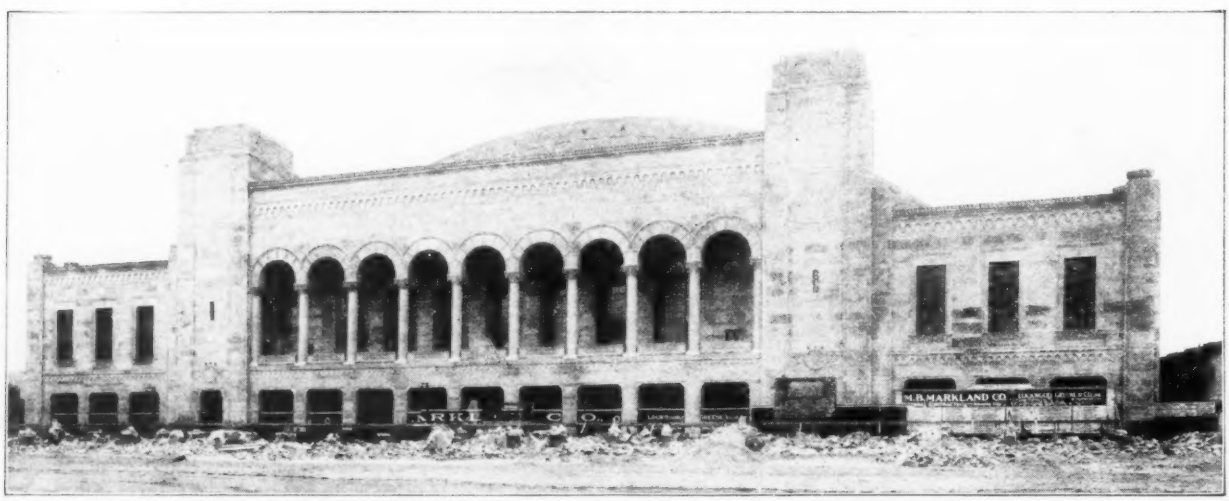
The equipment consists of two large freight elevators of the vertical steel screw type, each having a capacity of 50,000 pounds. A separate freight elevator having a capacity of 4000 pounds is provided for handling trunks and other freight, these elevators being provided with power-operated doors. A specially designed organ lift will raise and lower the two organ consoles from the orchestra pit to the stage level. There will also be a passenger elevator having a duty of 2000 tons.

The work on this building was started under the administration of Mayor Edward L. Bader and was in the direct charge of Commissioner Harry T. Headley. The architects are Lockwood-Greene and Company Inc., with Cook and Blount as associate architects. The associate engineer was Mr. Alexander H. Nelson of Atlantic City and the M. B. Markland Company were general contractors for the foundations and superstructure of the building.



GEORGIA AVENUE SIDE

This view was taken on the board-walk looking back toward the auditorium stage showing steps, ramp, and entrance doors

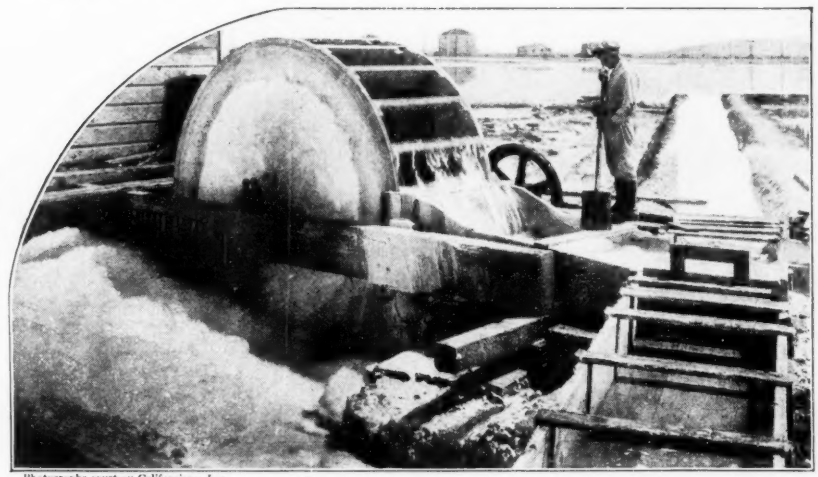


AS THE CONVENTION HALL APPEARED IN NOVEMBER

On the left tower of this imposing structure appear, carved in the stone, the words "Festivities, Music, Pageantry, Drama, Athletics"; on the right, "Education, Science, Conventions, Art, Industry." In the center, an inscription sets forth the ideals that inspired it

Salt from the Sea

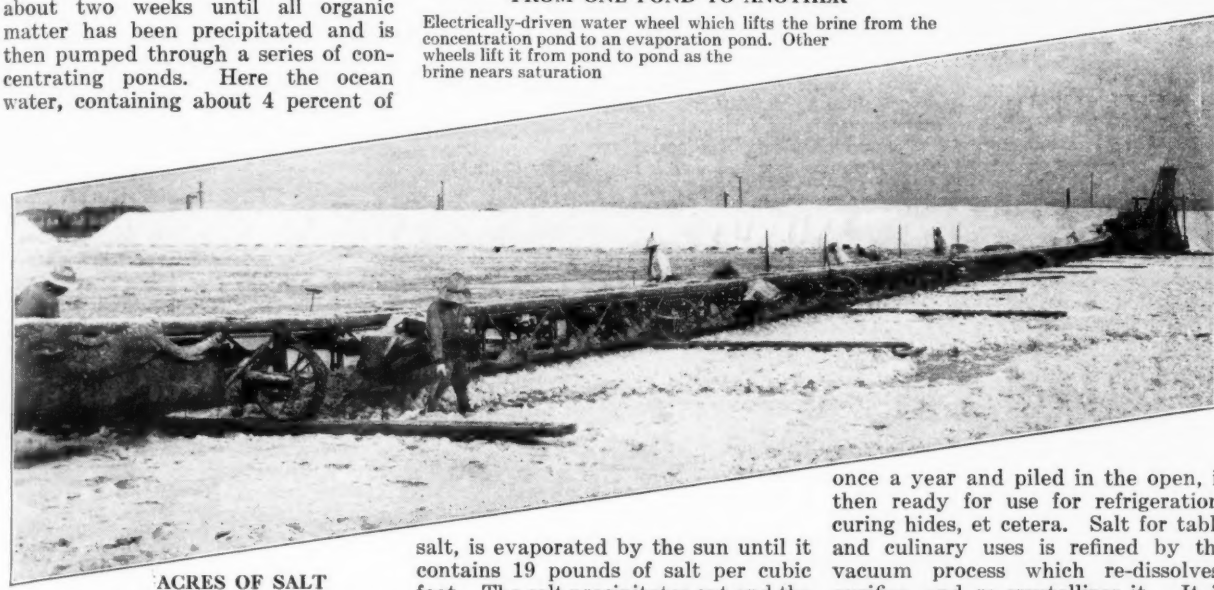
CALIFORNIA'S hot sun is good for something besides making a delightful climate; it is put to work reclaiming salt from ocean water. To the south of San Francisco, on the Oakland side of the bay, is the plant which utilizes solar heat for the evaporation process. At this plant, concentration ponds and harvesting fields occupy 15,000 acres. About once a month during the salt-producing season from May to October, ocean water enters a large intake pond. The water is allowed to stand in this pond about two weeks until all organic matter has been precipitated and is then pumped through a series of concentrating ponds. Here the ocean water, containing about 4 percent of salt, is evaporated by the sun until it contains 19 pounds of salt per cubic foot. The salt precipitates out and the remaining liquor is pumped back into the bay. The crude salt, harvested once a year and piled in the open, is then ready for use for refrigeration, curing hides, et cetera. Salt for table and culinary uses is refined by the vacuum process which re-dissolves, purifies, and re-crystallizes it. It is then conveyed to screens where it is graded ready for packing.



Photographs courtesy Californians, Inc

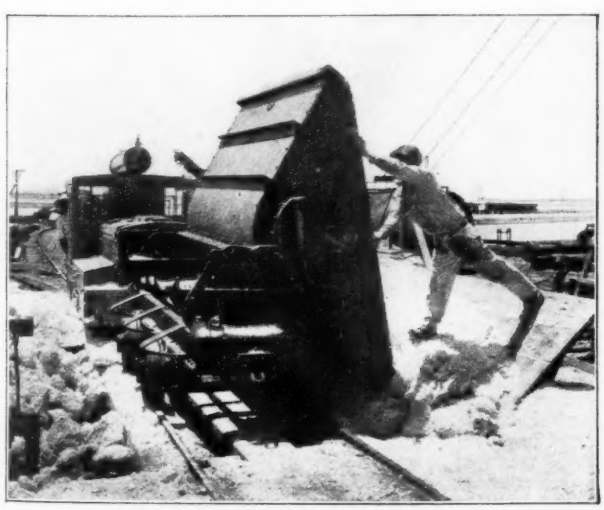
FROM ONE POND TO ANOTHER

Electrically-driven water wheel which lifts the brine from the concentration pond to an evaporation pond. Other wheels lift it from pond to pond as the brine nears saturation



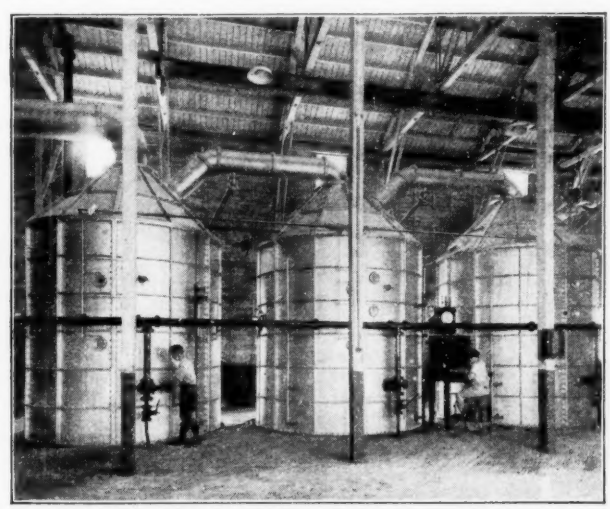
ACRES OF SALT

Harvesting crystallized salt. By this method, it is lifted by hand to conveying belts which carry it to the washer and piler



INTO ONE OF THE REFINERY PITS

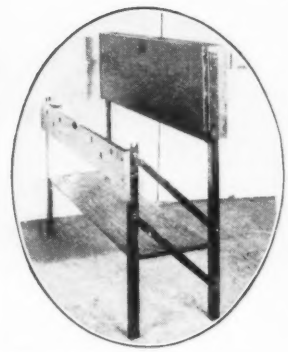
Thousands of tons of crude salt are brought to the refinery in trains of dump cars by a small gasoline engine and dumped into pits



VACUUM PANS FOR THE REFINING PROCESS

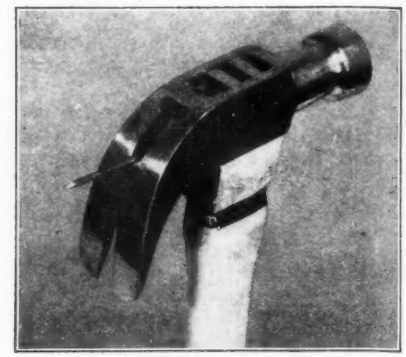
Obtained in its crude state by the ancient method of evaporation, the salt is then refined by a modern process, ready for table use

Tools for the Shop and Home



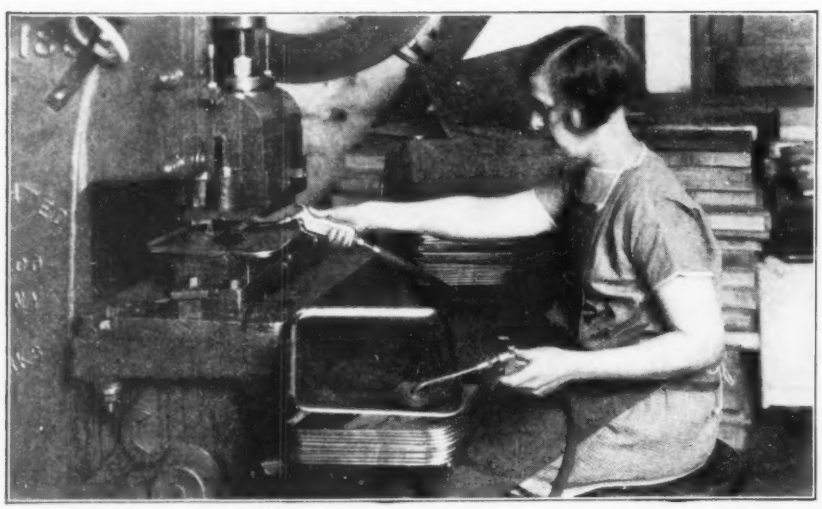
WORK BENCH HAS BUILT-IN TOOL CHEST

Supported by steel legs, this bench contains its own tool chest and has a wide working surface that folds back to encase the tools when not in use. The wooden parts of the bench are of spruce, stained inside and out. Among the 35 household tools included in the set are screw drivers, rules, pliers, chisels, bench brackets, saw, brace and bits, hammer, vise, pipe wrench, block plane, jack plane, and bench dog. The top of the bench is 33 inches from the floor and is 48 inches long by 16 inches wide.—*The Stanley Rule and Level Plant, The Stanley Works, New Britain, Conn.*



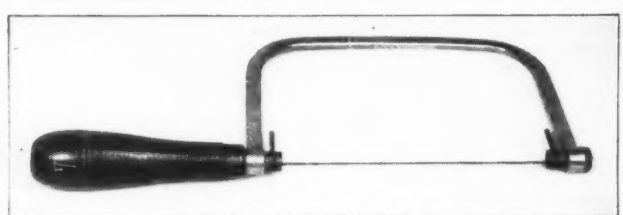
NAIL STARTER

Fewer injured thumbs will result from the use of this hammer, in which the nail is placed in the groove and started with a lusty blow. Otherwise built like a regular hammer, this tool will be appreciated where one hand must be left free to do other work.—*Hammacher, Schlemmer and Company, 133 Fourth Ave., N. Y.*



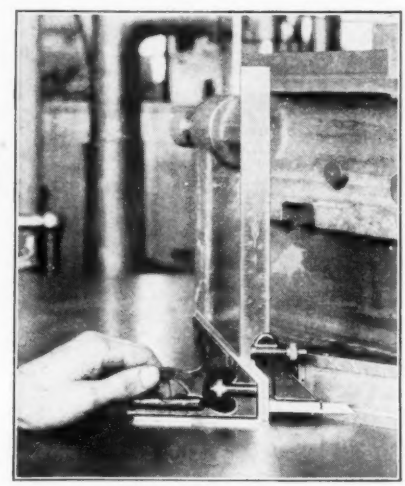
PRESS FEEDER

Feeding punch presses becomes less dangerous to the operator, and the rate of production is materially increased, by using these pneumatic "guns." As the air passes through the gun a vacuum picks up the object, exerting a force of about 12 pounds. The suction is released by a hand trigger.—*Michigan Metal Products Co., Battle Creek, Mich.*



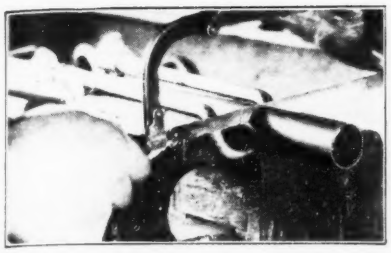
ONE-PIECE HAMMER: NEW SAW BLADE

At the left: Head and shaft of this hammer are cast in one piece of metal, eliminating the danger and loss of time resulting from the head flying off or coming loose. The handle is made of laminated leather, compressed and ground to shape. The one-piece design of the head and shaft also increases the driving power of the hammer, and improves the balance. *Above:* The blade of this saw is made of specially processed steel, set to saw through any material without the necessity of changing the blade. It cuts through fiber-board, wood, Bakelite, bone, metal, and other materials. Both of these tools may be obtained from *Hammacher, Schlemmer and Company, 133 Fourth Avenue, New York*



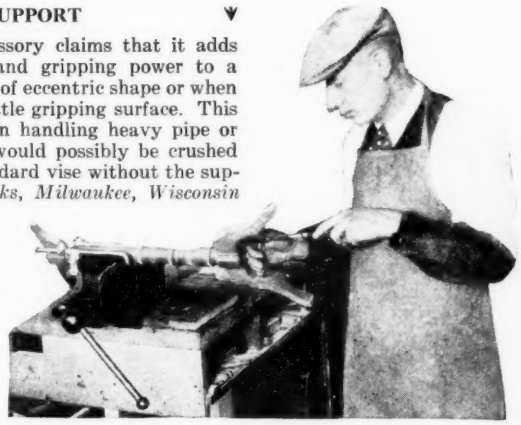
HEIGHT GAGE

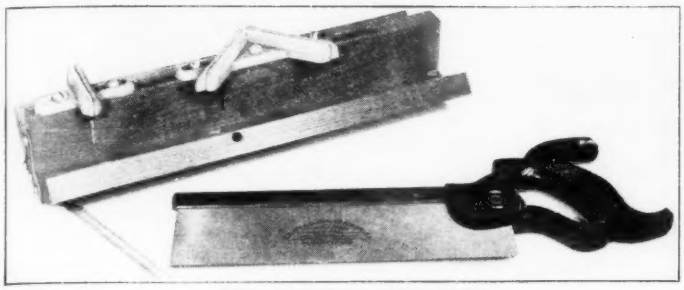
When used on the blade of the combination square this attachment makes the instrument a height gage. Users of combination squares or sets will find this device particularly useful for making comparative measurements and in finding heights of projections from plane surfaces.—*Brown and Sharpe Manufacturing Company, Providence, Rhode Island*



RIGID VISE SUPPORT

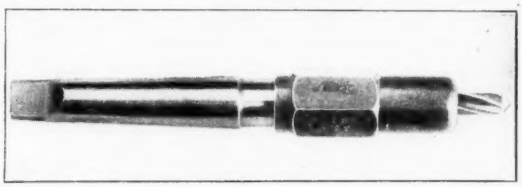
The manufacturer of this accessory claims that it adds practically unlimited holding and gripping power to a standard vise, especially on jobs of eccentric shape or when working with stock with very little gripping surface. This support is of particular value in handling heavy pipe or tubing and other objects that would possibly be crushed if they were to be held in a standard vise without the support.—*A. F. K. Fountain Works, Milwaukee, Wisconsin*





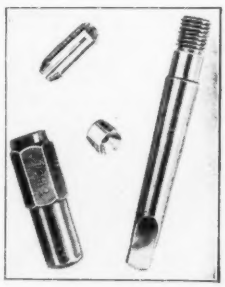
COLLAPSIBLE MITER BOX

Supplanting the usual bulky miter box of the carpenter shop, this improved device can be folded compactly to fit into a portable tool chest. The adjustable metal guides make it less difficult to turn out neat and accurate work, with a minimum of wasted time and material. When opened and ready for business, the box is made rigid by placing the steel pin through the hole in the base. Despite its convenient size and light weight, this collapsible miter box is solidly constructed and will stand exceedingly hard usage.—*Hammacher, Schlemmer and Company, 133 Fourth Avenue, New York City*



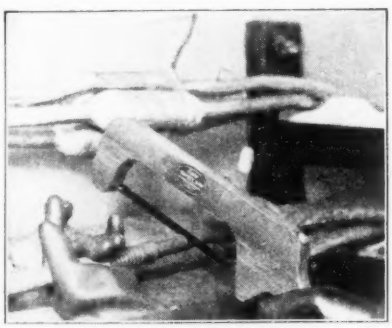
DRILL CHUCK

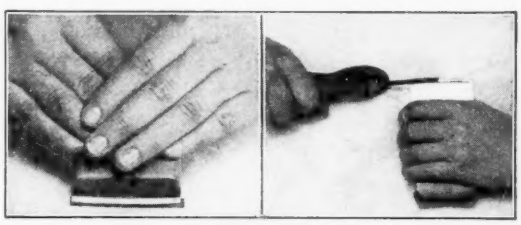
An improved drill chuck with drill in place, and some of its parts, designed to reduce vibration and the resulting breakage bills by providing the smallest possible projection of the twist drill. Another feature is that this chuck uses either double twist or standard drills—*Specialty Trading Corporation, 561 Fifth Ave., N. Y. C.*



HACKSAW

In cutting metal conduits or on other hacksaw jobs where there is possible danger from electric currents, this wooden handled hacksaw will be welcomed. The grip is built of seasoned hard wood and is shaped to fit the hand. Like other hacksaws, this safety saw uses standard blades which can be put in or removed without difficulty.—*Engineering Products Co., 25 Church Street, N. Y. C.*



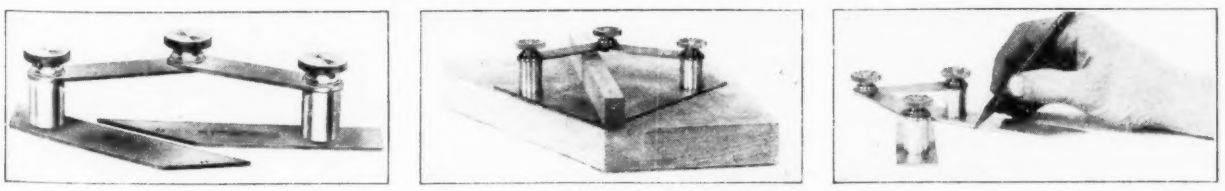


LIKE A VISE

This new tool operates like pliers and grips like a vise. Its compound leverage delivers a one-ton grip at the jaws, which fit round, square, or hexagon objects. The screw locks the jaws to any object.—*The Lawson Manufacturing Company, 2720 E. 53rd Street, Cleveland, O.*

HOOK SCRAPER

To meet the demand for a hand scraper with a cutting edge capable of cutting real chips, this new tool has been designed and patented. The hook scraper pulls toward the operator, and for fast scraping is held nearly perpendicular to the surface. For fine scraping it is held almost flat. The cutting edge can be extracted and re-sharpened.—*Hook Scraper Company, 96-85 219th Street, Queens, New York*



VERSATILE COMBINATION BEVEL

An unusually large number of combinations are obtainable with this instrument, and in every setting there is complete visibility of the angle. The blades can be set at any angle, and the height of the posts permits easy reading of the arc, as well as providing clearance for drawing or scribing lines the full length of the blades. The blades are of steel, ground on all sides and on their ends. To decrease the weight of the instrument, the posts are made of a light metal. An almost unlimited variety of combinations can be arranged without difficulty by using this instrument. By means of the clamp nuts, the blades can be either moved freely or securely locked. —*Brown and Sharpe Manufacturing Company, Providence R. I.*

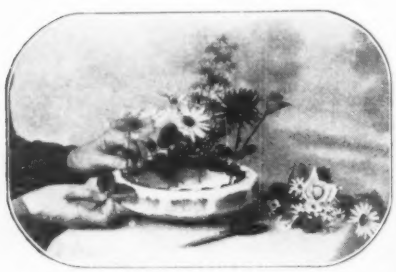
Household Inventions

PARING HOOK

The curved blade of this knife helps to speed up peeling jobs. The tip of the blade is curved also, for removing eyes and spots.—*Burns Manufacturing Co., Syracuse, New York*

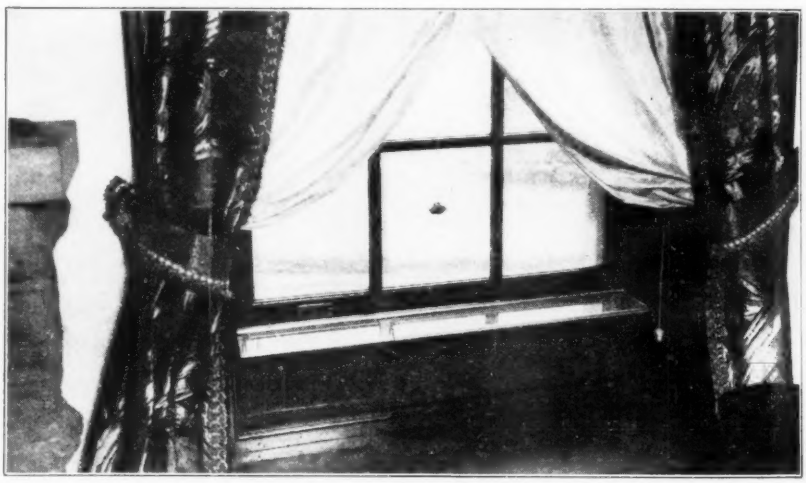
IMPROVED CHAIR

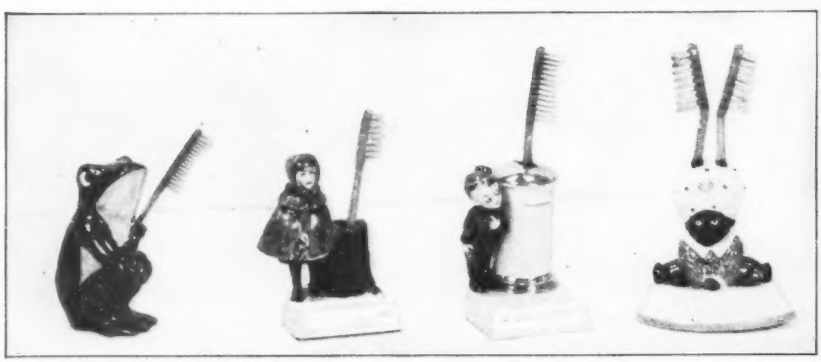
The lowly folding chair now appears in fancy dress. The latest model is made of steel, with leatherette seat and back, and is painted in a wide variety of colors. Each chair weighs approximately nine pounds.—*One-Flip Folding Chair Company, 1644 American Furniture Mart, Chicago, Illinois*



FLOWER HOLDER

A practical device for displaying short-stemmed cut flowers has long been sought. A flexible ring made of plated brass, that fits around the inner edge of a small bowl of any shape, holds such flowers in place very effectively. —*Mima K. Finlayson, 2125 Hillcrest Drive, Los Angeles, California*



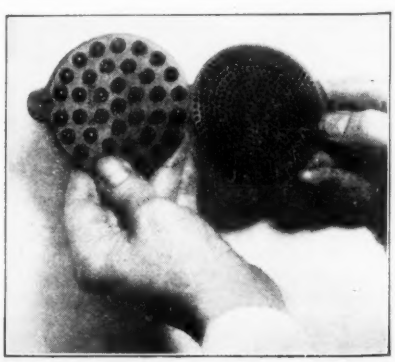


TOOTHBRUSH HOLDERS

Little children will not regard brushing their teeth an unpleasant task if their toothbrushes are held, when not in use, by one of these imported holders. These holders are made in a wide variety of shapes and colors, and are designed to appeal to children of all ages.—*Meyer and Lorang, 130 West 42nd Street, New York City*

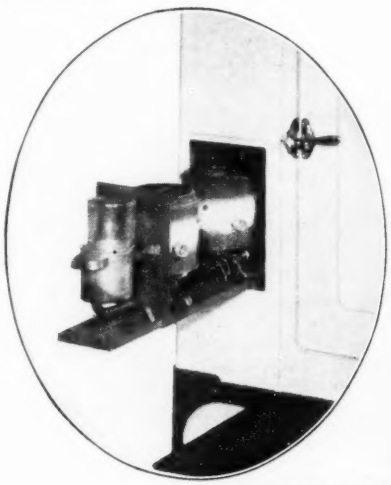
SCREEN VENTILATOR

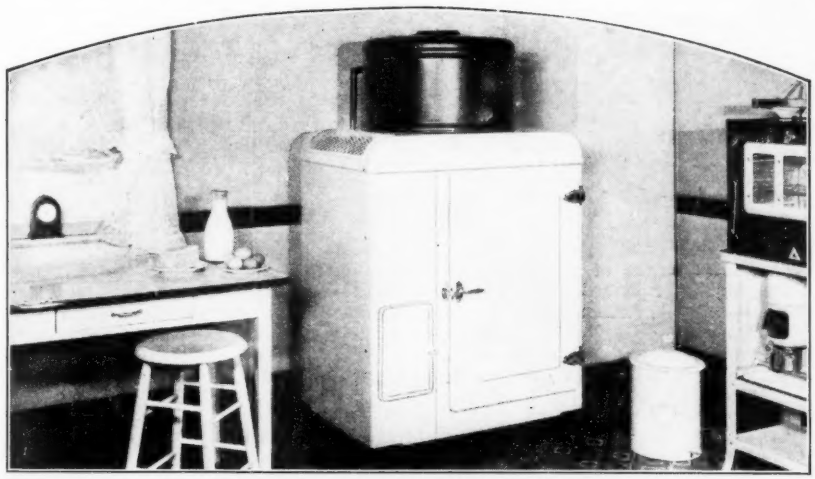
This adjustable ventilator is made to fit any window, acting as a screen as well as a draft guard. Built of heavy metal, with copper screening, it protects curtains from dust and rain.—*Hudson Superior Screen Ventilator Company, Inc., Real Estate Trust Building, Philadelphia, Pennsylvania*



HAND MASSAGE

Two sizes of rubber projections, the larger size containing vacuum cups, are provided on this little device which simplifies massaging. When in use, it is buttoned to slip over the fingers, enabling the manipulator to hold it firmly while it is being used, and quickly to change the face when desired.— *F. W. Woolworth Stores*



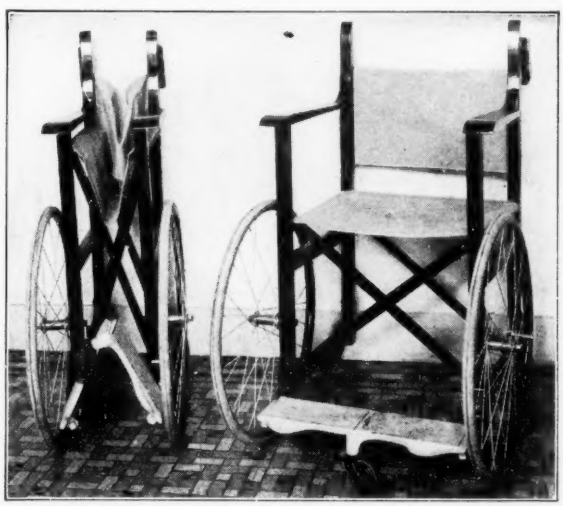


AUTOMATIC REFRIGERATORS NOW OPERATED BY KEROSENE BURNERS

To meet the demand for a modern refrigerator that will work anywhere, a new type home refrigeration plant has been perfected. Powered by the heat from a kerosene burner, this refrigerator operates automatically, silently, and requires no servicing. In appearance it compares favorably with modern gas and electric refrigerators, and can be used where other fuels are not obtainable. The cooling liquid is hermetically sealed in the refrigerator, which operates on the familiar principle of absorption. All the user has to do is to regulate the oil burner. Without inconvenience and at a cost of as little as two cents a day, residents of rural regions may now enjoy foods and drinks that can be kept pure and appetizing only with modern refrigeration. The model shown has about five cubic feet of food space.—*Perfection Stove Co., Cleveland, O.*

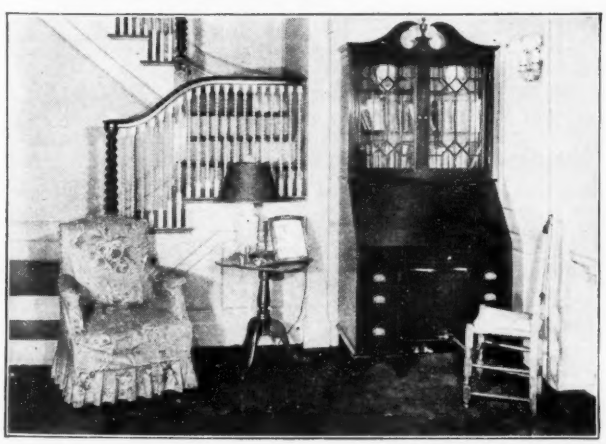
◄ SEWING BASKET

This work basket is ornamental as well as useful, and makes it possible to find the proper sewing articles at a moment's notice. The basket is eight inches in diameter and four inches high, with sidewalls of cretonne. —*Massillon Wire Basket Company, Massillon, Ohio*



WHEEL CHAIR ►

When not in use, this wheel chair can be closed up like an accordion and placed out of the way. The chair is equipped with rubber tires, and is designed for the support and comfort of its user. —*Torrington Specialty Company, Torrington, Connecticut*



COMBINATION WRITING DESK AND PIANO

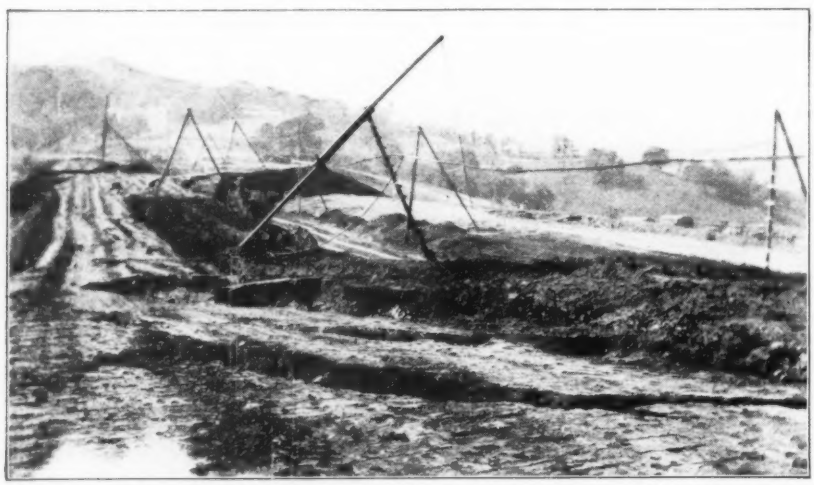
The designer of this quaint but handsomely built piece of furniture suggests that the lower compartment of the book-case would be an ideal place for the radio set. The entire combination would then include radio, book-case, writing desk, and piano. From the design and construction, one might presume it to be the product of an early American craftsman. Although the piano is small, its tone is said to be excellent.—*Piano Crafter's Guild, 82 Brown Place, N.Y.C.*

The Scientific American Digest

A Review of the Newest Developments in Science, Industry and Engineering

Lafayette Dam Failure

WHEN the Lafayette earth fill dam, which is part of the Mokelumne Project in California described in SCIENTIFIC AMERICAN for December, 1928, was about 90 percent complete, it failed partially by the slippage of a great area on the downstream slope. Cracks began to appear on that slope and a gradual settlement of the center, principally downstream, continued so that in a short time an area of almost 500 square feet had sunk approximately 20 feet.



A general view of the great area, on the downstream slope of the Lafayette Dam, which failed by slipping, or caving in, when the dam was almost complete

At the time of the settlement, there was but 15 feet of water behind the unfinished dam and no water damage was done. Had there been water behind the dam, it is possible that a devastating flood similar to that let loose when the St. Francis Dam failed, might have rushed through the valley below the dam.

The cracks in the Lafayette Dam showed a dry, homogeneous, and well-compacted fill. Therefore the failure cannot be attributed to methods of construction, nor probably to the design, since the dam has a conservative section. At the time this is written, engineers had not been able to state the cause of the settlement. To all appearances, however, and taking into consideration the known facts, it has been suggested that the foundation material in the stream-bed area beneath the dam lacked sufficient stability to support the weight of the dam. The sandy clay, possibly of a semi-fluid nature, was compressed—and perhaps continues to be compressed—by the great weight, and some of it was pushed out downstream and probably to a lesser extent upstream.

The 1928 West Indies Storm

ABOUT 1000 miles southeast of the eastern islands of the Caribbean Sea and 10 degrees north of the equator is an extensive area in which, in the latter part of the northern summer, the air moves slowly northwestward and in which local disturbances produce variable breezes which often result in a circular motion. All circular air near the earth's surface is in a counter-clockwise direction, if it is located anywhere north of the equator.

Sometime during the latter part of the first week of September, 1928, some variable breezes threw themselves into a circular motion or whirlwind which grew in size and circular speed, passed the tornado stage and became sufficiently large to be called a hurricane by the time it struck the French and British isles of Martinique and Dominica respectively, where much damage was done.

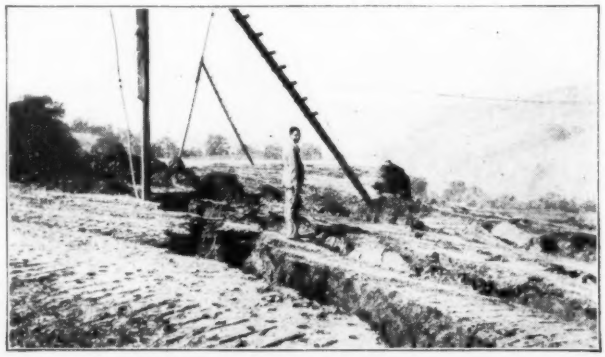
On the 12th and 13th it passed over Porto Rico, leaving great damage in its wake. It continued in its northwestward path, at the rate of 300 miles per day, passing over the Bahama Islands, and on Sunday, September 16, arrived at the Florida shore with its center at Lake Worth, a few miles south of Palm Beach. The reported time for the calm center to pass was from 4:00 to 6:30 P.M. Sunday. The estimated speed of the circular wind about the center was 150 miles per hour at maximum. The lowest barometer reading reported was 28.10.

The storm center then moved across Florida along a line joining the following towns,—Lake Worth, Canal Point, Sebring, Bartow, Lakeland, Brooksville, Tyler, White Springs, thence northeastward by Waycross, Ga., near Augusta, Ga., Columbia, South Carolina, Virginia Capes, Delaware Capes, and New Jersey coast.

The highest speed of the wind reported inland away from the coast was 75 to 80 miles per hour. By the time the storm center moved from Lake Worth to near Lakeland the speed was reduced from 150 to 75 miles per hour. Also no calm center was reported from any place after it left Lake Worth. The reduced speed, and trees and buildings caused the center to be broken and hence not so noticeable.

The energy which caused this storm and others to develop from a whirlwind into a hurricane, was supplied by the rapid condensation of the water vapor in and about the center of the rapidly rising air which was being pushed up by the cooler air flowing in from the north side. This energy and the size of the whirling storm continued to increase while it was traveling mostly over water. On this account the circular speed was at its maximum when

Close-up view of the "crest" from which point the earth of the dam pulled away. Note compactness of the soil



Another view to show comparative size of cracks in the dam. Marks in the foreground were left by tampers

it reached the Florida coast, at which place the calm center was about 30 miles in diameter. This calm center was caused by the centrifugal force of the wind about the center. This force was also equaled by the pressure of the outer air moving towards the center. The difference between the pressure at the center and the outer parts of the hurricane was about one pound per square inch or 3000 tons per acre or 2,000,000 tons per square mile when it hit the Florida coast.

As the huricane moved over Florida, part of the water vapor supply was cut off and so its circular speed was reduced. Trees, buildings, and small hills also had their checking and diverting effect so that no serious damage was done after it got well inland. The hurricane while over Florida was more than 1000 miles in diameter.

In Winter Park, Florida, the first hurricane winds were mild breezes from the northeast and they started on Saturday, September 15th. The wind was not constant but variable. During the worst part it would range from 30 to 75 miles per hour in a minute's time as indicated by the barometer reading at 3:55 A.M. September 17, when the barometer would change .02 inches in a minute.

It began to rain in Winter Park when the wind had changed to almost east and continued with intermittent showers until the wind shifted to the southwest at which time the storm center was northwest.

The temperature during the storm varied from 73 degrees to 77 degrees, Fahrenheit. Total rain in Winter Park was 3.75 inches.

The conclusion to be drawn from this study, according to Professor Lewis Elhuff, of Winter Park, is that, in the interior of Florida, houses and buildings should be erected to stand a wind of 80 to 90 miles per hour, while on the east and west coast of Florida they should be erected to stand a wind of 150 miles per hour, in order to avoid damages by hurricanes such as the one described above.

Radio Soprano Correction

IN connection with the article entitled "Why is a Radio Soprano Unpopular," which appeared in our October, 1928, issue, we published a chart of the musical scale which aided in illustrating graphically the reasons why a radio soprano is unpopular. The author of this article supplied us with the material for this chart, which was re-drawn by our artist.

It has now come to our attention that this chart was originally copyrighted by the National Association of Musical Instrument and Accessory Manufacturers. We are pleased to give credit here to the association for the preparation of this chart in its original form.

World's Best Collection of Rare Gases

MANY years spent in the study of gases, which have resulted in the accumulation of the best collection of rare gases in the world, is, in a sentence, the interesting career of Dean R. B. Moore of the School of Science and head of the Department of Chemistry at Purdue University, Lafayette, Indiana. Although there may possibly be someone in a foreign country who now has more rare gases, two years ago he obtained evidence that he had the only krypton and xenon in the United States, and the only pure samples in the world. So far as he knows, this fact is true at the present date.

Doubtless it has never occurred to you that when you take a breath, you inhale a bit of neon, argon, krypton, and xenon. These are four of the five really rare gases. Helium is the fifth.

Had it not been that these gases must be isolated from all foreign matter before they are of any use whatsoever, Dean Moore and many other scientists would have had an easy job of it. As it is, krypton and xenon are in our atmosphere only in the proportion of one part in 19,000,000 and one part in 190,000,000, respectively. Neon is a part of the air in the proportion of one to 55,000. Argon, forms about nine tenths of one percent of the atmosphere and at the present time is used extensively as a filler for electric light bulbs. All of these gases are chemically inert, have no color, smell, or taste, and are relatively hard to isolate—especially krypton and xenon.

Two little glass tubes which Dean Moore estimates are worth several hundred dollars each, contain what is probably every bit of perfectly pure krypton and xenon that exists. They look absolutely empty and useless but the careful handling which these tubes receive when the Dean exhibits them gives a slight impression of how highly they are valued by the man whom many writers have called the foremost authority on rare gases today. No practical use has as yet been found for them, therefore the samples have no intrinsic value.

"I made my collection," said Dean Moore, "during the time I was working with Sir William Ramsay about 1909, and also more recently in connection with the commercial production of helium. The tremendous strides made in helium

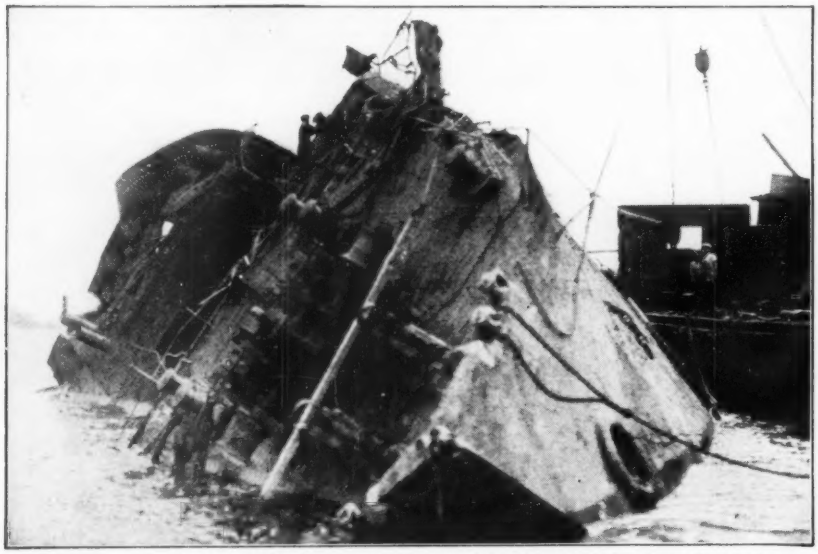
A freak of the West Indies storm. While the house was not demolished, the capitals on three of the columns were crushed by the downward force of wind

High pressure storage at the Naval Air Station at Lakehurst. Each cylinder holds 50,000 cubic feet of helium

The plant in Texas where helium is extracted from natural gases for use in the government's dirigibles

production since the war have made it a relatively common gas, and its use in airships has started a series of investigations which rob it of a good deal of its former mystery. Only yesterday, a cylinder of helium came in from the government plant in Texas, containing about 160 cubic feet—more helium than there was in the whole world before the World War. Helium can hardly be considered rare any more, and the other four gases, neon, argon, krypton, and xenon, are becoming better known every day.

"In a laboratory upstairs," continued Dr. Moore, "we are endeavoring to procure additional samples of xenon and krypton. Some time ago we received a cylinder of oxygen residues, rich in krypton and xenon, but it is a very slow process to procure these gases in pure samples."



When the Norwegian freighter, *Bessegen*, sank in New York harbor after being hit by a liner, it became a menace to navigation and had to be removed

Rubberized Violins Rival Old Masters

MODERN violins may be made to rival the product of the old masters by impregnating the wood with rubber latex before varnishing, according to the claim of a German investigator named Ditmar-Graz, writing in the scientific magazine *Natur und Kultur*. He states that this treatment causes the wood to remain permanently elastic.—*Science Service.*

Removing a Wreck from New York Harbor

A HUGE steel fragment of nearly 500 tons, the bow of the wrecked Norwegian freighter *Bessegen*, held the record for all time of weights lifted by floating derricks until it was eclipsed, a short time later, by a second section of the same ship, both raised recently by the Merritt-Chapman and Scott Corporation's floating derricks *Monarch* and *Conveyor*.

The *Bessegen*, a tramp steamer of 1900 tons, for more than a year has rested on the bottom of New York Harbor's "Upper Bay" where, at anchor one foggy night, it was rammed by an outbound liner and sank like a shot. Its cargo of sugar, of course, was a total loss, soon melting away to sweeten the waters of the bay. The hull, likewise damaged beyond profitable recovery, was classified as a "menace to navigation" by the United States Army Engineer Corps and now is being broken up and removed by the salvage company.

The unique plan of removing the whole ship in only four gigantic "bites," instead of many smaller ones, is made advisable by the hulk's position in one of the busy spots of the world's water traffic; such a plan is made possible by the vast power of the two super-derricks that are being used.

The *Monarch* is the newest and finest as well as the most powerful salvage derrick ever built. Its hull is of patented steel construction, built to withstand tremendous stress and strain. It is capable of lifting 300 tons over-side and has a specially designed water-ballasting system to counteract its list when hoisting and tending to keep it on an even keel. Its companion derrick, the *Conveyor*, was especially developed for this job and is almost as powerful as the *Monarch*.

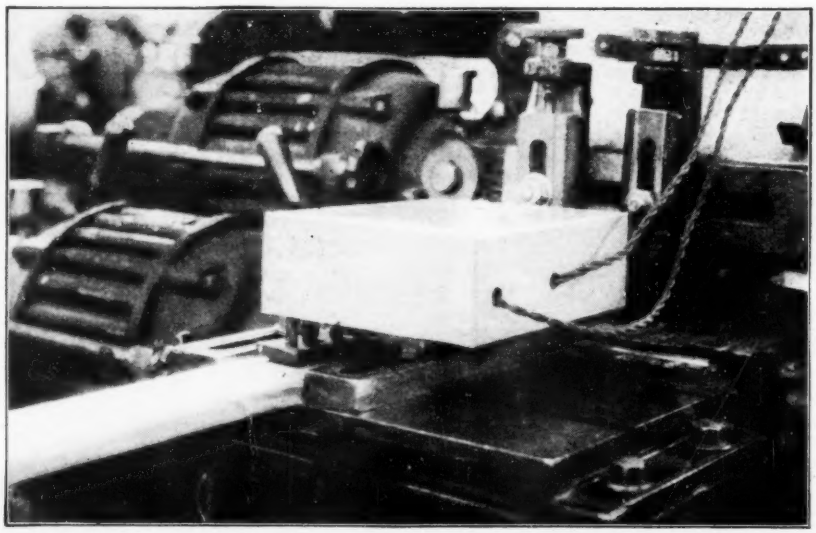
Work of dismembering the hulk is done by means of dynamite, the "salvage-man's hacksaw," accurately placed in position by divers. Before the third section is raised, vital parts of the ship's machinery will be separately removed, probably little damaged by the blasts except in the case of cast iron parts such as bed plates, frames, et cetera.

Device Measures Moisture in Lumber

THE market for American soft woods was for many years limited to construction fields where the principal items required were those entering into the building of dwellings, barns, outbuildings, fences, and so on, where specified moisture contents were of no moment or were easily met by the existing manufacturing practices. Higher standards in home and industrial engineering practices resulted in a call for more exacting standards covering the characteristics of lumber.

Portable device for measuring the moisture content of lumber. It consists of a two-point contact on a handle, and a meter and battery

Lumber shrinks in drying. The degree of shrinkage bears a definite relationship to moisture content. In order to be



The moisture-content apparatus on a planer. As the lumber leaves the machine, the device marks for rejection all lumber that has too much moisture

suitable for the purpose intended, a large percentage of lumber must be dried to a moisture content sufficiently low to prevent further shrinkage after the job is in place. It must be sufficiently free from moisture to permit finishing to a smooth surface and in a condition to receive and retain a suitable stain or paint.

The Forest Products Laboratory and the research departments of the various lumber trade associations have made surveys of most wood-consuming industries and have largely determined the various moisture conditions desired. As Albert Hermann, research engineer of the Western Pine Association, put it "The most pressing need and the most difficult problem at present is a practical moisture content measuring device."

R. L. Shropshire testing one of the specially designed bubble sextants

T. E. Heppenstall, research engineer, of Longview, Washington, has produced just such a device. It is an electrically-operated moisture detector that automatically determines moisture content. This device may be placed at a convenient point at a lumber assorting table where kiln-dried lumber is being unstacked and graded out and will instantaneously mark out all pieces delivered over the grading table that are unsuitable to apply on a given moisture content specification. The unsuitable pieces, bearing the mark applied by the detector, may then be sent back to the kilns to be re-dried to the proper moisture condition or pulled into a bin by themselves to apply on other orders where the lower moisture content is not required. A like detector, with a slightly different marking device may also be attached to a planer machine and will mark out each piece of lumber either wholly or in part above required moisture content while the lumber emerges from the machine. A third detector with an attachment consisting of needle-like contact points and a signal lamp set in a handle may be used at the car door to test lumber being loaded for shipment. The same device may be used by the buyer at destination to check in his shipment to be sure that he is getting what he ordered.

The Heppenstall invention is small, compact, and portable. It has but one moving part, is instantaneous in its action and may be operated from battery or light socket.

Mine Rescue Sledge-Stretcher

THE efforts of mine rescue crews are often retarded and sometimes nullified entirely by lack of equipment capable of taking care of rescued men under the varying conditions to be encountered. If the disabled or unconscious miner must be carried out through a narrow passage or up a narrow shaft, an ordinary stretcher does not suffice and, even if it did, the services of two men are required to carry a man to safety.

The firm of Drägerwerk in Lübeck, Germany, has perfected a sledge-stretcher which may be handled easily by one man. It has handles at one end while at the other the tube frame curves upward and around to form a two-point-contact skid. An apron straps tightly over the stretcher and extends up above the waist line of the man who is being carried. This apron holds the patient in place. Straps hold the man's head and shoulders. An oxygen tank and respirator are part of the equipment. This sledge-stretcher can be carried in a horizontal position or in a vertical position, the latter being necessary sometimes when a man must be hoisted out through a narrow shaft.

A one-man stretcher such as this one, which is made in Germany, is often necessary in mine rescues

Bubble Sextant Lighted by Flashlight Cells

UPON two flashlight dry cells, contained in a hand flashlight case, may depend the ultimate success of the Byrd Antarctic Expedition in its effort to circle the South Pole by airplane. Two intricately designed bubble sextants, one for the use of the expedition's Assistant Navigator, Ralph L. Shropshire, and one for use by Commander Byrd, as Chief Navigator, were taken on the *S. S. Larson* to the Antarctic. A bubble in the sextant corresponds to the visible horizon in observations taken to show the relationship between the sun and the visible horizon. At night or in cloudy periods of the day the bubble and sextant are illuminated by a bulb lighted by the flashlight cells, and thus it becomes possible to obtain accurate positions.

This becomes of supreme importance when the tri-motored Ford airplane takes off during the Antarctic six-months night or during stormy or cloudy weather, for South Pole excursions from the expedition's Antarctic base.

Failure to obtain proper bearings might easily throw the plane out of its course. By devising the flashlight case with its dry cells as a power source, Shropshire stated just before leaving New York that he believed he had overcome what promised to be an obstacle to successful position finding. Hitherto a much smaller dry cell has been employed in the handle of such sextants, the cell of necessity being made so tiny, in order to fit in the handle, that it afforded only a minimum power supply to run the light bulb, before exhaustion.

Shropshire is carrying with him several hundred extra flashlight cells, for use by

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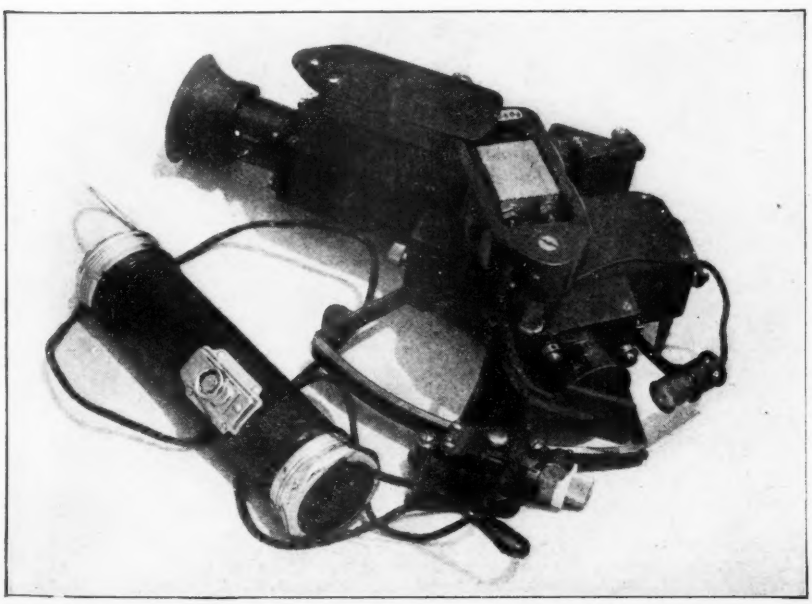


Bubble sextant taken on the Byrd Expedition. The bubble, indicating the visible horizon, is lighted, electricity being supplied by two flashlight cells

Industries From Atoms

A Department Devoted to the Advancements Made in Industrial and Experimental Chemistry

"Self-Rescuer" for Gas-Filled Mines

WITH carbon monoxide being blown into the city streets from millions of automobile exhausts, everyone is more or less interested in the poisonous effects of

This respirator is effective as a safeguard against carbon monoxide

this gas on the human system and in methods of protection against it. It is in the mines where this dreaded gas constitutes a real and terrible danger, after fires or explosions, and it is with the safety of miners foremost in mind that the United States Bureau of Mines has done its extensive experimental work on gas masks and respirators of all kinds.

Recently there has been developed the device known as the "self-rescuer." S. H. Katz and J. J. Forbes describe it in Miner's Circular 30, published by the Bureau of Mines, as follows:

" 'Self-rescuers' are pocket-size respirators that protect the wearer from air contaminated with the poisonous gas, carbon monoxide. The purpose of the 'self-rescuer' is to provide a miner with protection from carbon monoxide for at least half an hour and thus help him to escape from a mine in which a fire is burning or an explosion has occurred. A 'self-rescuer' can be used also by workers above ground who may through accident become surrounded by atmosphere containing carbon monoxide.

"Two hazards threaten the miner who escapes serious injury by fire or violence in a large mine fire or explosion. He may be poisoned by carbon monoxide or he may be suffocated by breathing an atmosphere that does not contain enough oxygen to support life. In order to save himself, the miner must either erect a barricade against afterdamp and wait until ventilation is restored, or take a long chance of getting out of the mine through entries free of afterdamp. Although the 'self-rescuer' does not supply oxygen, it does remove the hazard of carbon monoxide for half an hour or more and thus greatly increases a miner's chance of getting out alive. Thus the 'self-rescuer' is a life-saver for the miner, and 'self-rescuers' are as essential in mines as life preservers on ships.

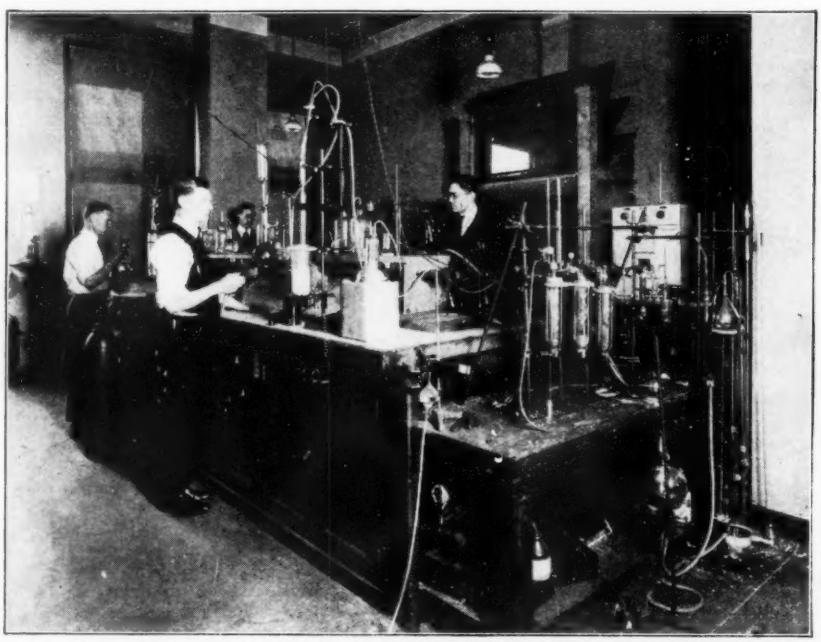
"The 'self rescuer' is a small canister made of tin plate, to which a mouth piece is directly attached. The wearer breathes by his mouth through the 'self rescuer'; breathing through the nose is prevented by a pinch clamp or nose clip on the nostrils. Both the nose clip and the 'self rescuer' are kept in the case, and a short cord between them keeps the nose clip from being lost.

"When the 'self rescuer' is put in use, the air the wearer breathes passes through certain essential parts and materials. First, inhaled air enters through small holes in the canister at the lower side (as held in the mouth) and then filters through absorbent cotton, held between wire screens, which removes smoke. Next is a layer of granular (14 to 20 mesh size) fused calcium chloride (90 cubic centimeters or five and one half cubic inches in volume), to absorb water vapor, which is always present in air and destroys the efficiency of the 'hopcalite', the material in the next layer. Hopcalite is a granular (14 to 20 mesh size) mixture of specially prepared manganese dioxide and copper oxide; 110 cubic centimeters (six and three quarter cubic inches) are put into the canister. This layer is separated from the calcium chloride by wire gauze. Hopcalite acts as a catalyzer; that is, it causes any carbon monoxide (CO) and oxygen (O_2) in the air that passes through it to unite and produce the relatively harmless carbon dioxide (CO_2)."

Novel Drying Trick Applied in Dynamite Manufacture

EXPLOSIVES manufacturers have, for some years past, been racing to produce dynamites of lower and lower density. Reducing the density of the explosive reduces the undesirable shattering effect in blasting out coal, for instance. To reduce the density of their dynamite they have used wood pulp, soaked in a solution of ammonium nitrate as the absorbent medium for the nitroglycerine. But a serious disadvantage of carbonaceous materials impregnated with ammonium nitrate is the difficulty and danger of drying. Ammonium nitrate retains water tenaciously at rather high temperatures, and long periods of drying are necessary to dry a moist mixture of ammonium nitrate and wood pulp. The dynamites made in this way are satisfactory as to explosive characteristics, but the risk of manufacture is too great to warrant their adoption.

A recently developed method of avoiding these difficulties, is described in a recent issue of *Chemical and Metallurgical Engineering* by B. I. Stoops. It consists of mixing with the ammonium nitrate a few percent of hydrated magnesium nitrate (United States Patents 1,671,792 and 1,671,793). Hydrated magnesium nitrate



Pressures of 3000 pounds per square inch and temperatures lower than -300 degrees, Fahrenheit, are frequent in this Cryogenic Research Laboratory of the United States Bureau of Mines in Washington, D. C. The research data supplied by this laboratory were of primary importance in determining the production cycle of the new helium gas plant at Soncy, near Amarillo, Texas

melts in its water of crystallization at 198 degrees, Fahrenheit. After mixing in the proportions of 20 percent of hydrated magnesium nitrate and 80 percent of ammonium nitrate, the mixture melts in its water of crystallization at 230 to 240 degrees, Fahrenheit. When thus melted it can be incorporated with balsa sawdust and will impregnate the latter thoroughly. Upon cooling, the water present reverts again to the form of water of crystallization and the mixture is then to all intents and purposes physically dry. Thus the dangerous and expensive operation of drying mentioned above is completely avoided.

This clever application of a simple bit of chemical knowledge has produced a dynamite with very decided advantages.

Humidity Control Prevents Explosions

RADIO has taught us to associate the word "static" with horrible noises, but we sometimes recall, on second thought, that the phenomenon referred to is fundamentally electrical and was only a mild novelty even in the days when we stroked the cat the wrong way in the dark to watch the sparks. In this connection, we recall the experience of the New Bedford city fathers who devised a closed chamber filled with illuminating gas for the merciful dispatch of stray tomcats. In several instances some particularly lively specimens, presumably with a number of their nine lives still in reserve, greatly accelerated the execution by discharging static sparks in the explosive atmosphere.

Static discharges have been responsible for many disasters where explosive chemicals are used. For example, it has been stated that every year 1000 women are burned to death as a result of fires from dry-cleaning at home. Even the commercial dry cleaners have experienced such explosions caused by static sparks, produced by the scrubbing, igniting the naphtha or other solvent. Dr. C. H. Wardell, Jr., Chief Chemist of the Ohio Chemical and Manufacturing Company of Cleveland, pointed out in a recent issue of *Hospital Progress* that there is a remedy for static electricity. Industry has already solved its problem. Increased humidity supplemented in certain cases by proper grounding has reduced the static hazard to a negligible quantity.

"The percentage of relative humidity required to dissipate static charges is a question of debate; however, we may well be guided by the previous experience of other investigators in similar fields. One authority states that a relative humidity of 50 percent at 70 degrees, Fahrenheit, entirely disposed of static troubles in a rubber factory. Another company handling flammable materials also found that 50 percent relative humidity prevented explosions from static. A well-known dry-cleaner, having experienced six explosions, and having exhausted all other means, raised the relative humidity to 40 percent and had no further trouble. It has been shown that a relative humidity of 45 percent gives a safe atmosphere, preventing static difficulties and consequent fires in the churn and spreader rooms of the rubber industry."

This picture is silent testimony of the destruction caused by a dust explosion in a large industrial plant

Dangers in Dust Pointed Out By Expert

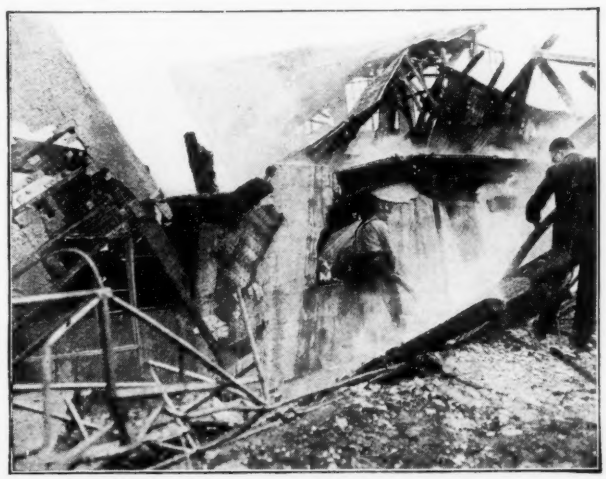
CONSIDERABLE attention has been given in recent years to dust explosions in industrial plants. The dust explosion research studies in the Bureau of Chemistry and Soils of the Department of Agriculture have been confined for the most part to grain handling or milling industries. In many instances, however, the Bureau has been called upon for assistance by many other types of industries in which dust explosions have occurred and in which protection was essential. David J. Price, engineer in charge of the Chemical Engineering Division of the Bureau, (*See also page 552, June, 1928, issue,* SCIENTIFIC AMERICAN.—*Editor*) is probably the country's leading authority on this hazard and to him we are indebted for the photographs reproduced herewith.

Research studies of the Bureau of Chemistry and Soils have demonstrated that when mixed with air in proper proportions combustible dust of almost all types can be ignited with explosive violence. There are at least 28,000 industrial plants in the United States subject to the hazard of dust explosions, according to the estimate of Mr. Price. These plants employ approximately 1,324,000 people and annually manufacture products valued at more than 10,000,000,000 dollars.

In recent years dust explosions have occurred in many industries where they had not previously taken place so that the number of industrial plants where the dust explosion hazard exists appears to be constantly increasing. In addition to the explosions in what might be termed grain handling and milling operations, there have been explosions from the dusts of starch, sugar, powdered milk, chocolate, spice, rice, cotton-seed meal, wood, powdered rubber, paper, fertilizer, sulfur, zinc, magnesium, dye materials, coal tar pitch, leather, and many others. Minor explosions often cause serious fires.

As a result of extensive experimental work by the Bureau of Chemistry and Soils and observations made during actual operation of inert gas systems in industrial plants, the value of inert gas as a means of preventing dust explosions has been so well demonstrated that its use should be seriously considered wherever an explosion hazard exists which cannot be controlled through the elimination of the dust cloud or the source of ignition. The use of inert gas is particularly recommended in grinding, bolting, or any phase of a manufacturing process where an explosive dust is produced or handled in an enclosed piece of equipment.

(*Please turn to page* 176)



Lacquer spraying constitutes one of the greatest hazards in modern industry. These pictures illustrate the results of explosions caused by igniting minute particles of pyroxylin lacquer used in manufacturing airplanes

Learning to Use Our Wings

This Department Will Keep Our Readers Informed of the Latest Facts About Airplanes and Airships

CONDUCTED BY ALEXANDER KLEMIN
In charge, Daniel Guggenheim School of Aeronautics, New York City

The Chicago Air Show

THE recent air show at Chicago brought together exhibits of every type of plane, engine, and accessory. It was held in the Chicago Coliseum with an overflow in the near-by armory. There were over 75 planes of different types on display and perhaps 25 different aircraft engines.

The show commemorated the 25th anniversary of heavier-than-air flight, when the Wright brothers made their first flight on December 17, 1903.

The Hon. Irving W. Glover, Assistant Postmaster General, announced to visiting delegates of the International Aeronautical Conference (held in Washington) that with the completion of certain new lines, and the granting of additional air mail contracts, a letter mailed in Montreal on Monday at noon would arrive in Santiago, Chile, by the following Saturday.

Air lines already cover the greater part of the United States, and aviation is rapidly encompassing Central and South America.

On November 1, 1928, there were 55 operators of air transport routes in the United States. Forty of these carried passengers in addition to mail and express, while 20 were devoted to passenger traffic exclusively. With the coming of 1929, there may be three (certainly two) transcontinental passenger services in operation, equipped with large tri-motored planes of the most luxurious type.

During the month of October, air-mail contractors handled 467,422 pounds of mail, which may be roughly estimated at 8,000,000 letters, an increase of 10 percent over the preceding month.

At the present time there are 14,941 miles of airways in operation in the United States. More than 40,000 miles are flown daily by the regular commercial services, and when the new lines scheduled are put into effect, the daily mileage will amount to 51,000.

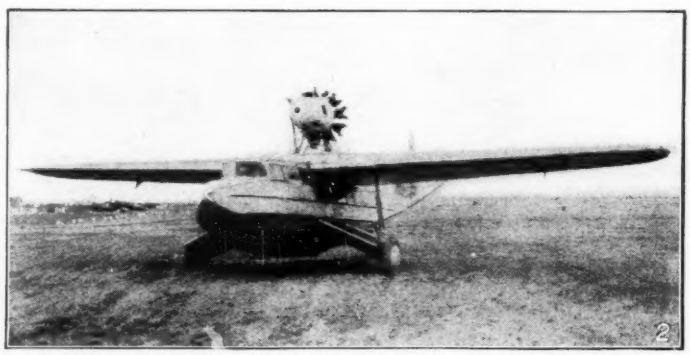
A recent report of the Aeronautical Chamber of Commerce indicates a tremendous increase in airplane production. In 1921 not a single commercial airplane was built. In 1927, there was a production of less than 2000 planes with a total value of 14,000,000 dollars. For 1928 the report of the Chamber indicates a construction of 4000 planes of all types, with a market value of 25,000,000 dollars. For 1929, members of the Chamber have a schedule of 10,000 to 12,000 planes, the market value of which will exceed 100,000,000 dollars.

The year has seen financing of aircraft companies, planes, engines, and transport to a value of at least 50,000,000 dollars. Aircraft securities are purchased by the public as soon as issued. [*See page 148. Ed.*]

On September 1, 1928, there were 1196 airports and landing fields in operation in the United States. Airports fully equipped with flood lights for landings, flood-lighted buildings, boundary lights, danger lights, et cetera, are to be found in almost every state of the union.

On October 31, there were, according to a census of the Department of Commerce, 4134 privately owned planes, and the number of such privately owned planes is rapidly increasing. California leads all other states in plane population, with 639 planes used by civilians. New York state ranks second with 387 planes, and Illinois ranks third with 350.

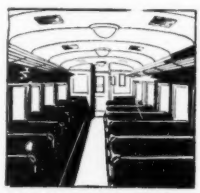
There are now 2678 licensed pilots in the United States. In this number military and naval pilots are not included. The Department of Commerce reports that pilots receive from 35 dollars to 150 dollars per week, and the average salary of a competent pilot ranges between 75 dollars and 100 dollars. The large transportation services such as National Air Transport, Boeing Air Transport, et cetera, give their aviators a steady base pay, which, coupled with mileage, nets the pilot something like 5000 dollars per year. At the present time, while there is no lack of pilots of ordinary caliber,



Some of the new aircraft seen at the Chicago exhibition. See also text above. 1: The Kasstek American-built glider, which is on the market and offered for sale to private flyers. 2: A striking view of the latest Sikorsky amphibian. The stubs raise when the wheels are retracted, and the wheels disappear within them. 3 and 4 are views of the Driggs *Skylark*, a plane powered with a 60 horsepower, four cylinder in-line, inverted engine

Manufacturers and inventors use this *grainless* wood to make good products better

The making of broad pieces, peculiar shapes and curved surfaces often makes it difficult to obtain low cost production. But Masonite Presdwood solves these trying problems. This grainless wood is readily cut, sawed, punched, or curved. It resists moisture and takes any finish. Write for a generous sample. Then try it for yourself.



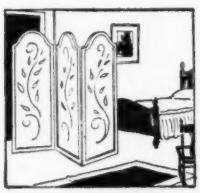
FOR RAILROAD COACH CEILINGS

Reports of new uses for this grainless wood are coming in daily. A manufacturer solves a production problem, cuts costs or widens his market. A mechanic develops new ways of working and finishing it. An inventor finds it meets requirements better than any other material. And—three years after placing Masonite Presdwood on the market—we, who make and sell it, are still wondering just how far its range of usefulness will finally extend.

Builders of fast motor boats and outboard hydroplanes say that Presdwood gives their craft lightness, strength and speed. Contractors use it for concrete forms because the resulting smooth surfaces cut their labor costs to the bone. And from far and near come orders from makers of road signs who wish to take advantage of Presdwood because it is easily worked and quickly painted.

Presdwood IS wood

Presdwood is made of wood—exploded to separate the fibres—then formed, with heat and enormous pressures, into uniform boards, 1/8 inch thick, four feet wide and twelve feet long. The same wood binder (the lignins) that held the wood fibres together, again cements the fibres of Presdwood, but now there are no knots, no grain, and no cracking, checking or splitting to mar the beauty of the finished product, or worry the manufacturer.



FOR BEDROOM SCREENS

Where broad surfaces, beautifully finished, are essential—there you will find Presdwood. It is used in paneled walls of apartments and office buildings. It is used for broad side panels of motor truck bodies and the interiors of Pullman cars. And in the moving picture studios of Hollywood it is artistically employed to portray the ballrooms of the rich and the palaces of kings.

Does not warp—resists moisture

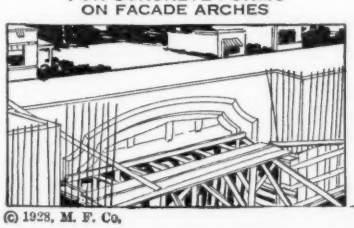
Because of its freedom from warping and buckling, and because of its resistance to moisture, we find Presdwood used for the tension boards of radio loud speakers, for bedroom screens, work bench tops, campers' tables, bread boxes, dairy product containers and starch trays for candy factories.

And when you try Presdwood for yourself, you will find that it will solve a manufacturing problem, reduce costs or make a good product even better. Write for a large free sample. It will be sent promptly on request.

MASONITE CORPORATION
Sales Offices: Dept. 734, 111 W. Washington St.
Chicago, Illinois

Mills: Laurel, Mississippi

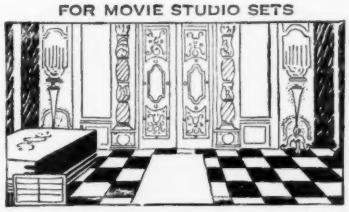
FOR CONCRETE FORMS ON FACADE ARCHES



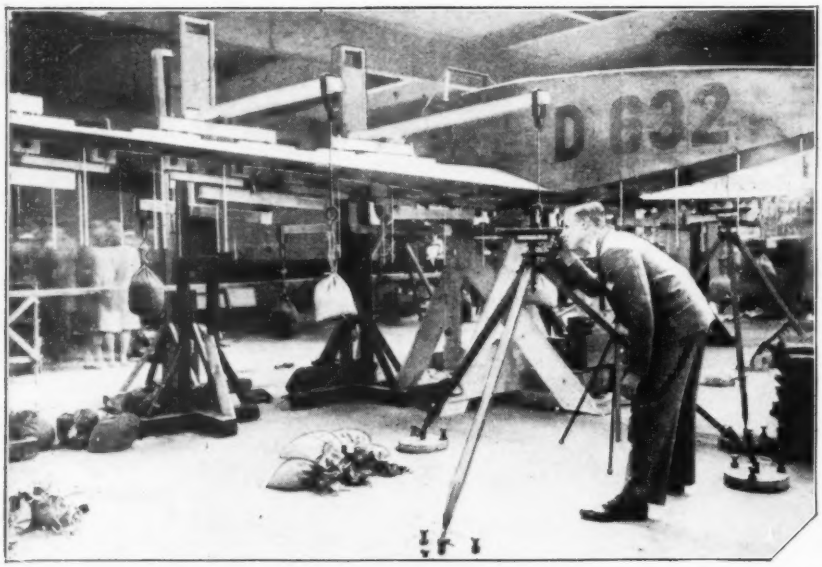
Masonite PRESDWOOD

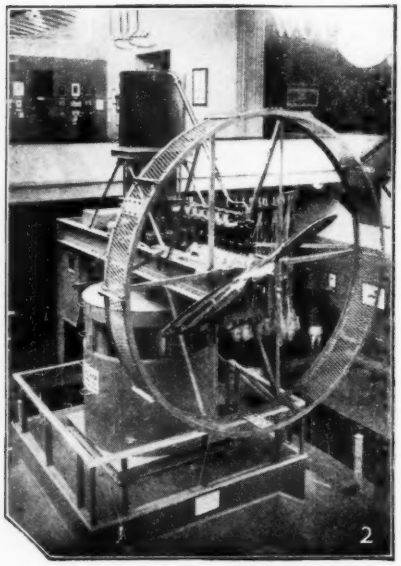
Made by the makers of
MASONITE STRUCTURAL INSULATION
REG. U.S. PAT. OFF.

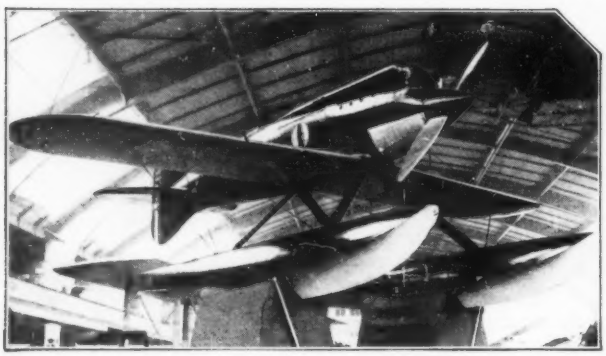
FOR MOVIE STUDIO SETS

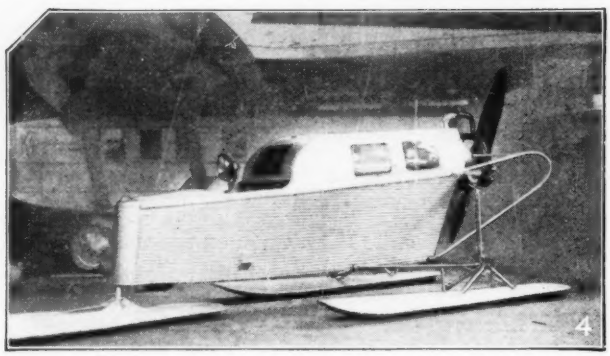


© 1928, M. F. Co.









Exhibits at the International Air Travel Exposition held recently in Berlin. 1: Testing the wings of a monoplane. The ship is inverted as explained in these columns. The observer watches the degree of bending. 2: A huge testing stand for aircraft engines. 3: The Italian monoplane, *Macchi 52*, which made a flight at 328 miles per hour. 4: While not an aircraft, this sledge embodies refinements developed for aerial use

the demand for qualified transport pilots with a thousand hours or more to their credit greatly exceeds the supply. Apparently the training of pilots is one of the pressing problems of the day. To meet this situation the Curtiss Flying Service is planning the establishment of 75 training schools, with 25 scheduled for early operation.

At the Aircraft Manufacturers' Section meeting of the Aeronautical Chamber of Commerce, the regulation of flying schools was one of the most important questions discussed. It was recommended that all schools recognized by the Chamber should have as minimum requirements instruction courses that would qualify students for a private pilot's license and that a certificate from the school should only be given on completing such a course. The Flying School Committee further recommended that every school should use exclusively planes licensed by the Department of Commerce and that every instructor should have a transport pilot's rating.

Another point taken up by the Aircraft Manufacturers' Section was the question of standardized performance testing. The Aeronautical Chamber of Commerce, in conjunction with various universities giving courses in aeronautical engineering, will carry out a plan of standardized performance testing, so that manufacturers' advertisements may be absolutely reliable in this respect.

At the show, the general tendency seemed to indicate a search for still greater speed on the one hand, and more attention to passenger comfort, cabin, and door finish on the other. A striking example of the latter tendency was the new Fokker amphibian, in which comfortable seats are supplemented by two attractive couches. This ship, equipped with a Pratt and Whitney Wasp motor of 400 horsepower, was one of the "star" exhibits. The design of the retractible landing gear is particularly ingenious mechanically. As the wheel is retracted, the stub wing is raised, and the wheel disappears within the stub.

An American built glider, with wings rigidly trussed with dural tubing, and an outrigger tail, with the man standing upright at the instant of launching, was exhibited for sale and met with much interest.

There is quite a vogue for in-line, air-cooled engines. The famous Cirrus Mark III engine was exhibited by the American Cirrus Engines company which is going to put the engine into production in the United States.

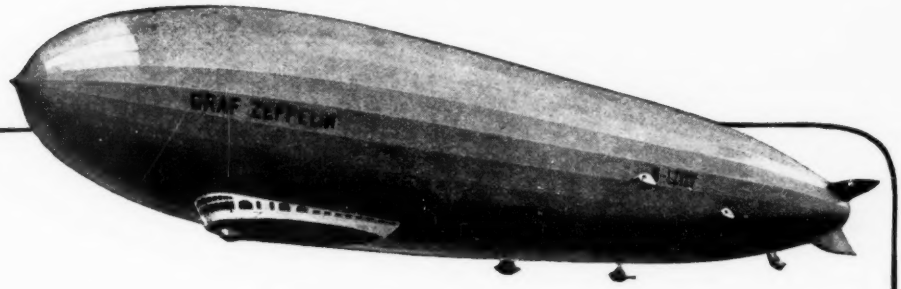
Inverting the engine seems to attract the plane designer. The Driggs *Skylark* is equipped with a 60 horsepower, four-in-line, Rover engine. The inverted engine gives the upper part of the fuselage nose a particularly clean appearance and removes cylinder heads and the like from the pilot's view. The Driggs *Skylark* is advertised as the "personal airplane." It is said to have a high speed of 110 miles per hour, and a climb of 900 feet per minute. Its weight, empty, is 665 pounds. With fuel and oil for 300 miles and pilot and passenger it weighs only 1115 pounds. The price "flyaway" is about 3200 dollars.

ILA

THE recent Internationale Luftfahrt Ausstellung (ILA), (literally International Air Travel Exposition), at Berlin contained so many interesting exhibits that it is difficult to select the more striking novelties.

At their expositions the Germans believe in informing the public of the scientific methods underlying aircraft construction. In our shows, engines, planes and accessories only are reckoned among the exhibits. One of the exhibits at Berlin shows a wing in process of strength testing. The fuselage is mounted in a solid jig, and in an inverted position, with the wings attached. When the wings are loaded, the force of gravity simulates the air forces which in flight are upwards. The loads are applied gradually—one, two, three and even more

(*Please turn to page* 182)



"I smoke a Lucky instead of eating sweets."

Grace M. Hay Drummond Hay

Lady Grace Drummond Hay, only female passenger on the Graf Zeppelin.

Lady Grace Drummond Hay, first woman to fly the Atlantic from Europe to the United States.

"The fact that we were not permitted to smoke from the time the Graf Zeppelin left Friedrichshafen until we landed at Lakehurst only increased my appetite for a Lucky Strike. Oh, how good that first one tasted! I'm really keen for Lucky Strike—the toasted flavor is delightful. I smoke a Lucky instead of eating sweets—that's what many men have been doing for years. I think it high time we women smoked Luckies and kept our figures trim."

LADY GRACE DRUMMOND HAY

The modern common sense way—reach for a Lucky instead of a fattening sweet. Thousands are doing it—men keep healthy and fit, women retain a trim figure.

Lucky Strike, the finest tobaccos, skilfully blended, then toasted to develop a flavor which is a delightful alternative for that craving for fattening sweets.

Toasting frees Lucky Strike from impurities. 20,679 physicians recognize this when they say Luckies are less irritating than other cigarettes. Athletes, who must keep fit, testify that Luckies steady their nerves and do not harm their physical condition. That's why Luckies have always been the favorite of those men who want to keep in tip-top shape and realize the danger of overweight. That's why folks say: "It's good to smoke Luckies."

A reasonable proportion of sugar in the diet is recommended, but the authorities are overwhelming that too many fattening sweets are harmful and that too many such are eaten by the American people. So, for moderation's sake we say:—

"REACH FOR A LUCKY INSTEAD OF A SWEET."

Reach for a Lucky instead of a sweet.

"It's toasted"

No Throat Irritation—No Cough.

© 1929, The American Tobacco Co., Manufacturers

Current Bulletin Briefs

Short Reviews of Bulletins and Papers on Scientific and Allied Subjects, and Where to Get Them

Construction

NATIONAL LUMBER PRODUCTION REGISTER AND DIRECTORY is a 165-page index of lumber manufacture by states, producers, products manufactured, and varieties of wood used. This handbook is a standard guide to all marketing phases of the industry. *National Lumber Manufacturers' Association, Transportation Building, Washington, D. C.—Gratis.*

A STUDY OF THE FAILURE OF CONCRETE UNDER COMBINED COMPRESSIVE STRESSES, BULLETIN NO. 185, deals with an investigation of the failure of concrete under compound stresses from varying directions. The aim of the tests was to study the internal action of the material as it breaks down under comparative pressures, and to determine the ability of concrete to resist longitudinal stresses. *Engineering Experiment Station, University of Illinois, Urbana, Illinois.—Gratis.*

OLD PAVEMENTS MADE NEW describes many instances where paved roads have been successfully re-surfaced with asphalt. The illustrations represent many sections of the country, and apply to a wide variety of traffic conditions. *The Asphalt Association, 441 Lexington Avenue, New York City.—Gratis.*

TYPHOON FANS AND VENTILATING SYSTEMS, a 102-page booklet, portrays a wide variety of cooling, heating, and ventilating system installations. The booklet is copiously illustrated with photographs, diagrams, and flow-sheets, showing methods of providing properly cooled or heated fresh air to theaters, restaurants, hotels, and public buildings. *Typhoon Fan Company, 345 West 39th Street, New York City.*

SELECTING CULVERTS AND DRAINS ON THE BASIS OF COST PER YEAR is a helpful 22-page booklet, particularly for those engaged in highway, railway, or municipal construction. This little booklet shows how to evaluate various types of structures serving the same purpose. *Armco Culvert Manufacturers' Association, Middletown, Ohio.—Gratis.*

Fuel

NATURAL GAS MANUAL FOR THE HOME, TECHNICAL PAPER NO. 325, will be of general interest in communities supplied, or to be supplied, with natural gas. *United States Bureau of Mines, Department of Commerce, Washington, D. C.—Gratis.*

INDUSTRIAL GAS IN THE UNITED STATES—GROWTH AND TRENDS presents discussion and statistics showing how the sale of natural, manufactured, coke-oven, and blast-furnace gas has varied during the past decade. The paper is illustrated with photographs showing typical applications of gas consumption in major industries. *American Gas Association, 420 Lexington Avenue, New York City.—Gratis.*

FIVE HUNDRED TESTS OF VARIOUS COALS IN HOUSE HEATING BOILERS, BUREAU OF MINES BULLETIN 276, is a 74-page treatise covering an extended study of the comparative heating values of various kinds of coal from different parts of the country. A bibliography of fuels and heating equipment is included in the bulletin. *Superintendent of Documents, United States Government Printing Office, Washington, D. C.—15 cents.*

Manufacturing

COTTON FABRICS AND THEIR USES is a little pamphlet of interest to anyone even remotely connected with the cotton or textile industries. *New Uses Section, Textile Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.—Gratis.*

COMPETITORS WHO HAVE CO-OPERATED TO IMPROVE QUALITY is a well-prepared 30-page booklet describing an interesting organization that has worked out a practical solution to the problem of industrial competition within a limited field. *Electrical Steel Founders' Research Group, 541 Diversey Parkway, Chicago, Illinois.—Gratis.*

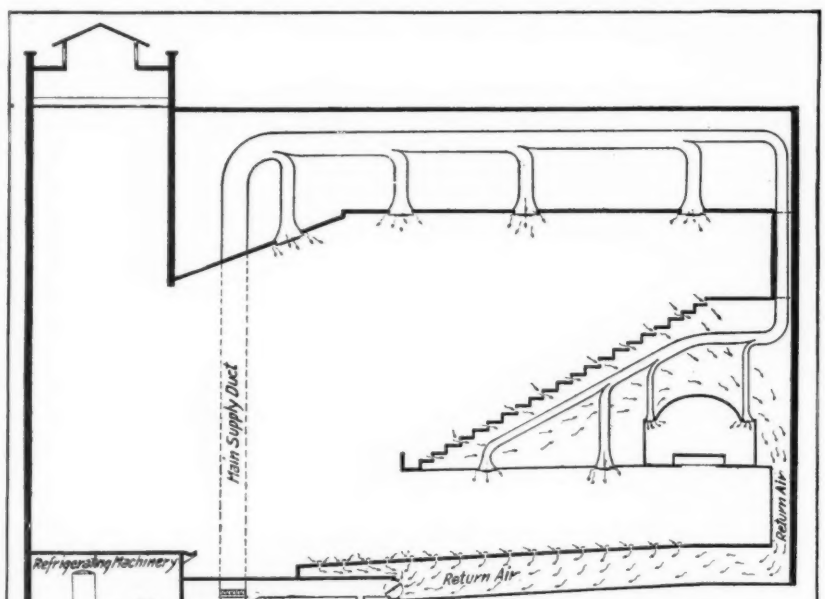
PRODUCTION OF EXPLOSIVES IN THE UNITED STATES DURING 1927, BUREAU OF MINES TECHNICAL PAPER 435, shows not only the production of explosives in this country during the period covered, but also presents statistics showing the amount used by various industries in the United States and abroad. *Superintendent of Documents, United States Government Printing Office, Washington, D. C.—10 cents.*

Metals

SUMMARIZED DATA OF COPPER PRODUCTION is a study of the production of copper during the 19th and 20th Centuries, through the year 1927. This paper graphically illustrates the increasingly important part played by the United States in supplying the world with this important metal. This report is the first of a new series presenting similar long-time production data of the other common metals. *United States Bureau of Mines, Department of Commerce, Washington, D. C.—Gratis.*

PHOTOMICROGRAPHY AND ITS APPLICATION TO MECHANICAL ENGINEERING, a 20-page illustrated paper by F. F. Lucas of the Bell Telphone Laboratories, presents a series ot observations by the aid of high-power metallography and the ultra-violet microscope on the hardening of steel. *The Bell Telephone Laboratories, 463 West Street, New York City.—Gratis.*

(*Please turn to page* 179)



This sketch from the booklet *Typhoon Fans and Ventilating Systems* shows a theater installation which automatically controls humidity and temperature

Sore throat

breeds in crowded, drafty places

Gargle when you get home

Listerine full strength *kills even typhoid germs in 15 seconds*

AS soon as nasty weather sets in, thousands are down with sore throat, colds, grippe, flu, or worse.

Don't be one of them. Gargle with Listerine full strength every day—especially after exposures to rain, severe cold and coughing crowds in public places—buses, street cars and movies. This simple act may spare you a costly and possibly a dangerous siege of illness.

Because Listerine, full strength, is powerful against germs—and sore throat, like a cold, is caused by germs.

Repeated tests show that Listerine kills even the stubborn B. Typhosus (typhoid) and M. Aureus (pus) germs in 15 seconds.

The safe antiseptic

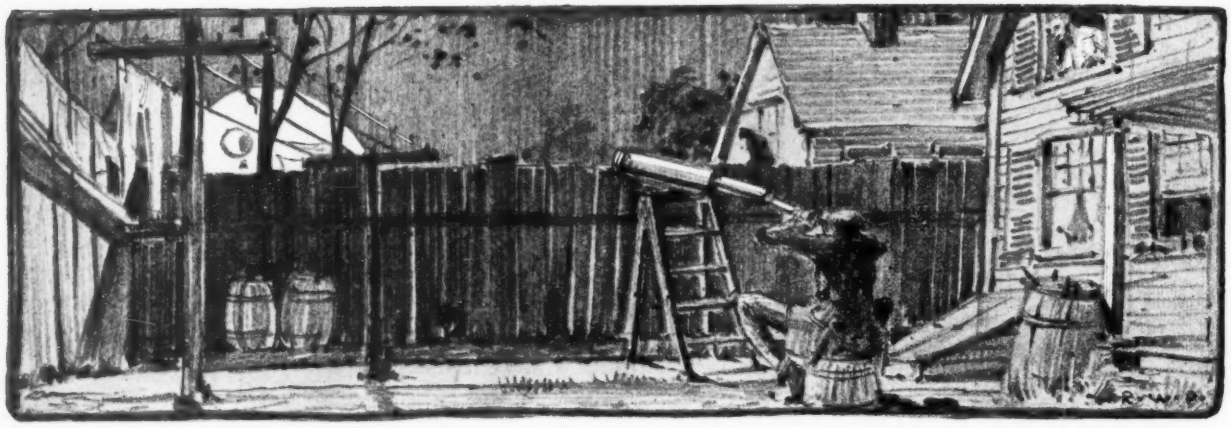
Realizing Listerine's power you can understand its effectiveness against the milder winter complaints caused by germs. Each year increasing millions rely on it.

Keep a bottle handy and at the first sign of trouble, gargle repeatedly. Don't hesitate to use it full strength. It is entirely safe in any body cavity.

If a throat condition does not rapidly yield to this treatment, consult your physician. Lambert Pharmacal Company, St. Louis, Mo., U. S. A.

Fewer colds *—if you do this*

Millions of colds start when germs, transferred from the hands to food, enter the mouth. Therefore, before every meal, rinse your hands with Listerine. This effectually destroys disease germs. This simple act may save you a nasty siege with a cold. And it is especially important for mothers to remember when preparing children's food.



The Back Yard Astronomer

A Department Devoted to Interests of the Amateur Telescope Maker

NOW that we amateurs in the north are finding it so easy to keep cool this month at our telescopes, a picture of the Southern Cross Observatory in Miami, Florida, showing amateur astronomers dressed in Palm Beach suits, may have some sort of an effect upon our feelings. Clarendon Ions, joint author of the SCIENTIFIC AMERICAN instruction book *Amateur Telescope Making*, sends in the photograph. He states that "this observatory was endowed seven years ago by Mr. S. Lynn Rhorer, F.R.A.S., of Atlanta, Georgia, who started then with one telescope. Each year one is added by Mr. Rhorer, who also augments the staff of volunteer trained assistants. All the glasses are Clarke refractors.

"Some nights 3000 or more people attend, and they are given opportunity to view some celestial objects and hear various educational talks. The average this winter is 1500 per night, the observatory closing at 10 P.M. Early morning observing is done two mornings per week, and attended by only a few of the faithful."

Leslie Long, of Cornelius, Oregon, describes a rather unusual telescope as follows:—"The mount, which was made by Jesse Watson, is of the equatorial type with hollow declination axis, with the eyepiece in a fixed position on the end of the polar axis. All the parts were machined out of stock material, with the exception of a two and one half inch pipe "T", a phonograph motor and a Ford front spindle, which is used for the polar axis. The spindle is rotated by gears, through a friction clutch built into the brake drum. The clutch allows motions of the spindle without the gears, if desired. The "T" was dressed up in a lathe and a steel bearing for the declination bearing was fitted in the side opening. In the remaining opening a steel fitting was placed, which holds the eyepiece tube and focusing arrangement, as well as one of the prisms, this being three quarter inch size.

"A one and one-half-inch prism is mounted inside the tube, both prisms being in line with the declination axis and bringing the light from the mirror to the eyepiece with any position of the telescope. The tube is balanced on the declination axis by a lead weight, and about the polar axis by another weight.

"The phonograph motor is mounted inside the steel stand. The polar angle may be adjusted, without interfering with the gear train.

"The six-inch mirror was ground and finished by me, under difficult circumstances. No basement was available and the work was done in the open air, with the final shadow tests made in an ordinary living room. Temperature troubles were

(*Please turn to page* 177)

The trim Long-Watson telescope

The visiting public at Miami, making use of the unique Southern Cross Observatory

READ WHAT

Prominent Astronomers Say

about

AMATEUR TELESCOPE MAKING

"I BELIEVE it meets a real need, and the SCIENTIFIC AMERICAN is to be congratulated on publishing such a volume." *E. A. Fath, Associate Editor, Popular Astronomy.*

"I CONGRATULATE you on its many improvements and am sure it will attract a large number of real workers into astronomy. You are doing a splendid service for science." *George E. Hale, Hon. Director, Mt. Wilson Observatory.*

"PERHAPS few younger men will feel the same enthusiasm as one who counts more than 60 years of interest in telescopes, but such will surely acquire gratitude for your work with increasing knowledge; they will even learn that if they follow the history of the telescope from the beginning of the 17th Century to our own times, they will have been brought into mental contact with all the great mathematical philosophers of three centuries." *Charles S. Hastings, Prof. Emeritus of Physics, Yale University.*

"I FIND the book is nearly completely perfected and now the best book of its kind . . . . . Since the August of 1926 there are thousands of mirror workers in Japan. Most of them were young students of teens age, which seems to be somewhat different compared with most American workers." *Prof. K. Nakamura, Astronomical Observatory, Kyoto University, Kyoto, Japan.*

"IT is the only book of its kind known to the reviewer and can be highly recommended as it deals with the subject in a practical way by authors who have actually made the instruments about which they write." *Review in Popular Astronomy.*

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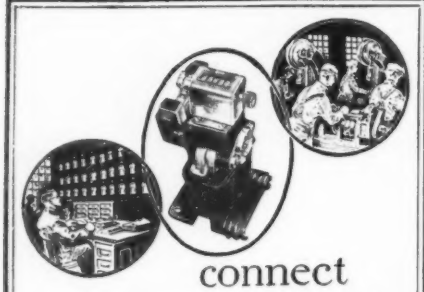

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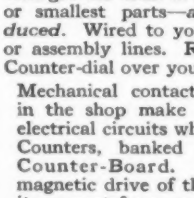

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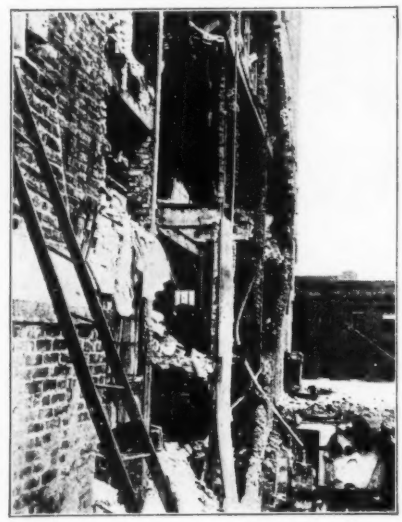
Industries From Atoms

(*Continued from page* 167)

The saving of life, property, and products is vitally related to the conservation of national resources. Although we have made progress in obtaining scientific data on the causes of dust explosions in certain types of industrial plants and in the development of methods for their control and prevention, it is apparent that this problem is extending into many new industries in which the hazard is now being definitely recognized.



The result of another dust explosion followed by a serious fire

The Chemical Engineering Division of the Bureau of Chemistry and Soils is very desirous of continuing to co-operate with the industries and other interested agencies in obtaining further information regarding the dust explosion problem, and of rendering any possible assistance in the development and application of effective methods of prevention and control.

Synthesis of Benzol From Methane

FRANZ FISCHER, distinguished German chemist and Director of the Kaiser Wilhelm Institute for Coal Research, was one of the speakers at the recent Bituminous Coal Conference in Pittsburgh. His paper entitled, "The Formation of Benzol and Other Hydrocarbons by the Action of Heat on Methane" showed that (1) methane can be converted into benzene and other benzene hydrocarbons if it is heated to temperatures of 1000 to 1200 degrees when keeping the heating period shorter than 10 seconds. Under these conditions processes can be carried out under ordinary pressure and catalyzers are unnecessary, (2) conditions can be so adjusted that the chief reaction products consist of benzene hydrocarbons, more than half of which are benzene; and the amount of unsaturated hydrocarbons in the residual gas can be reduced to 4 percent.

More About Chromium Plating Hazards

COMMENTING on an item published in this department in our December issue referring to health hazards in chromium plating and suggested safeguards, Dr. H. S. Riederer, of New Rochelle, New York, very kindly calls the following pertinent information to our attention:

"During a part of my practical experience in technical chemistry, I was connected with a chromate plant and there saw something of the effects of chromic acid and its salts on human tissues. Our greatest troubles were the "chrome sores" on exposed parts of the body. These are often very painful and prevent proper night rest. It occurred to me then that the irritating cause was primarily chemical with the chromic acid radical as the chief offender. Trial quickly showed that the chromic acid radical is easily reduced to chromic hydrate, which is not irritating, even in a sore. Applying a solution of bisulfite of soda to a sore, has this effect. The region of the sore soon becomes less sensitive and the bisulfite solution can be worked into the depths of the sore. Sores which had been several months old and continually creeping, were permanently healed in a week or two and the workman was relieved of pain during the healing. This matter was published in the *Journal of the Society of Chemical Industry* about 1905 or 1906, entitled 'The Treatment of Chrome Sores.'"

Bulk of Asphalt Comes From Petroleum

THE principal source of the asphalt so largely used in the construction of the nation's highways is by many thought to be the famous pitch-lakes of Trinidad, but the fact is that asphalt derived as a product in the refining of petroleum far outranks other asphalts in importance, according to the United States Bureau of Mines, Department of Commerce. The total value of the yearly sales of petroleum asphalts is nearly ten times that of native asphalts and related bitumens.

Very little petroleum asphalt was manufactured before the 20th Century, as the asphaltic materials that were obtained as residuals by refining were of inferior quality. With the rise in production of asphaltic base petroleum in California during the early part of the 20th Century, the discovery of the beneficial results obtained by the use of steam in refining, and the growth of asphalt in public favor as a road-building material, the petroleum asphalt industry was placed on a firm basis and grew rapidly. A further impetus was supplied when Mexican petroleum, which has a high asphalt content, was imported in quantity for the first time.

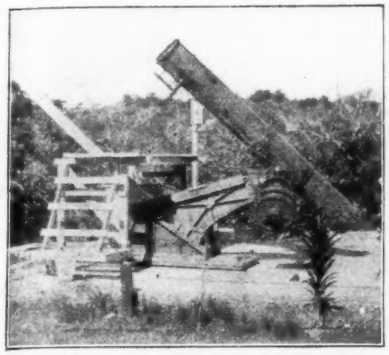
The term "asphalt" is commonly used to denote the various forms of bitumen found in nature or produced by refining. The term includes: Native asphalt, which in the United States is generally associated with other mineral matter, such as limestone and sandstone, and is usually called bituminous rock; the "related bitumens"—a series of natural hydrocarbons, of which only gilsonite, grahamite, ozokerite, and wurtzilite (elaterite) are of commercial importance; and petroleum asphalt, the major class, obtained in the refining of oils of an asphalt base or a mixed asphaltic and paraffin base. Native asphalt of the "pitch lake" type is not found in the United States in sufficient quantities to compete with the celebrated Trinidad and Bermudez Lake deposits, which together suppy nearly all of the asphalt imports of this country.

The Backyard Astronomer

(*Continued from page* 174)

great, but the mirror was brought to a perfect paraboloid and shows very good definition at high powers. The telescope is at Pacific University for student use."

It is interesting to note the wide variety



A 12½-inch reflecter by Calver, the celebrated English maker, owned and used by Professor William H. Pickering, at Mandeville, Jamaica, B.W. I. Note low angle of polar axis for 18 degrees north latitude

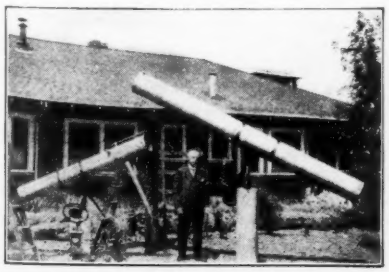
of vocations represented by our list of amateur telescope makers. The description quoted below comes from a physician, Dr. J. J. Byl, of 430 South 13th Street, San Jose, California. Obviously, Dr. Byl is a real enthusiast, else he would not have made two such businesslike telescopes as those shown in the illustration.

"In sending you pictures and a brief description of my telescopes," says Dr. Byl, "I believe I have no other motive than to be helpful in stimulating an interest in a useful and noble activity for young and old. In including myself in one of those I have done so only on your command. [Yes, we prefer this.—Ed.]

"I am a retired physician well along in years but have great anticipations of joy in so profound a study as the boundless Universe, and I am sure that my days will never be shortened by a loss of activity or interest in life.

"My ten-inch telescope has done good service for some time, although the silvering has not been by far what it might be. I have not had good success with the Lundin process. After three failures with the 12½ inch speculum, I followed Brashear's method and was surprised with my easy success.

"The tube of the larger instrument is 13 inches by 12 feet and the focus of the speculum is 12 feet, 4½ inches. The material is 16-gage galvanized iron with the edges all butted and soldered and the joints reinforced with bands of the same material. The mountings of the smaller



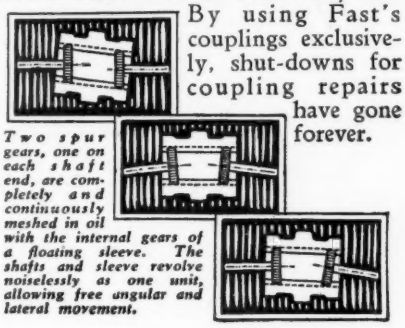
Dr. Byl and his two reflectors

This Book Tells How To Eliminate Coupling Shut-downs

Read what an authority says on how to avoid failure due to fatigue

AS LONG as there is any flexible material between your source of power and your driven machine, you are inevitably faced with the probability of failure and shut-down for repairs. Any flexible coupling built on old practice of using flexible bushings, pins, springs, discs or grids, keeps your plant subject to shut-down when you least expect it.

Since 1920 this has been avoided in thousands of plants. Scores of the country's largest equipment manufacturers have avoided it on machines they sell. By using Fast's couplings exclusively, shut-downs for coupling repairs have gone forever.



Two spur gears, one on each shaft end, are completely and continuously meshed in oil with the internal gears of a floating sleeve. The shafts and sleeve revolve noiselessly as one unit, allowing free angular and lateral movement.

Purely Mechanical Flexibility

See how simple it is. Mechanical flexibility is used throughout. See the diagram. See the way simple or compound misalignment is taken up by the floating sleeve principle. Instead of relying on flexible materials that would inevitably fail, all misalignment is taken up between the gear faces. Oil, under centrifugal pressure, carries the load.

Today over twenty million horsepower is being transmitted through Fast's couplings, only because coupling users have discovered that Fast's coupling is a permanent piece of transmission machinery, bought once and for all, and not calling for constant replacements and repairs.

For Your Equipment

No matter how complicated your coupling problem is, remember that Fast's couplings are made to meet all conditions, from small pump and blower service up to huge steel mill reversing drives.

FAST'S
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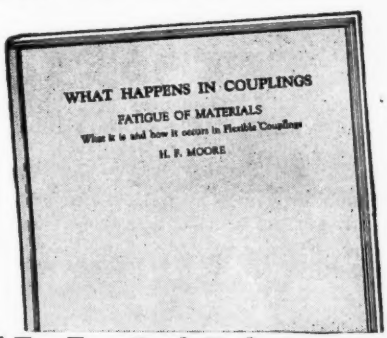
Without flexible bushings, pins, springs, discs, grids or any other flexible materials.

At first, Fast's couplings went into new installations only. Now engineers and plant superintendents are finding it profitable to change to Fast's couplings at once, and avoid expensive shut-downs before they occur.

Send For Free Book

Do not fail to send for the new book telling how couplings can now be made without flexible materials, and why the use of mechanical flexibility will eliminate coupling failures in your plant.

The full facts will convince you that Fast's coupling solves the costly coupling problem once and for all.



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one are of shaped steel and pipe; and of the larger one, castings from my own patterns. The shafts are cold-rolled steel selected to fit exactly the inner faces of the Timken ball bearings at both ends of all shafts.

"I wish to call special attention to the compact and strong cradle of steel plate for the tubes, and the pedestal on a base of rejected kitchen tanks which can be had for little or nothing.

"The smaller instrument can be driven by clockwork. The larger one will have an electric motor drive in which the speed is reduced by three worms and a small pinion on a ring gear, shrunk on a brake drum. The latter serves as a circle also.

"The 2-by-32 inch finder is now made and mounted.

"Invention and machines have since my boyhood been as natural as eating. I do all the work myself and with pleasure, consequently, the cost in money is not great." So writes Dr. Byl.—*The Tel. Ed.*

The Heavens in February

By PROF. HENRY NORRIS RUSSELL, Ph.D.

At 11 o'clock: Feb. 6.
At 10½ o'clock: Feb 14.
At 10 o'clock: Feb. 21.
At 9½ o'clock: March 1.
At 9 o'clock: Mar. 7.
At 8½ o'clock: Mar. 15.
At 8 o'clock: Mar. 22.

NIGHT SKY: FEBRUARY AND MARCH

MERCURY is an evening star until the 7th and a morning star afterwards. Toward the end of the month he rises more than an hour before the sun, and should be easy to see.

Venus is an evening star at her greatest apparent distance from the sun (on the 7th) and is very conspicuous. She remains in sight until 9 P.M. and may easily be seen before sunset, or even at noon if the air is really clear. The afternoon of the 13th, when she will be about 8° to the right of the moon and nearly at the same altitude, will be a good time to look for her.

Mars is now receding rapidly from the earth but is still a prominent object about as bright as Capella. He is on the border of Taurus and Gemini and comes to the meridian about 8 P.M.

Jupiter is an evening star in Aries and sets a little after 11 P.M. in the middle of the month.

Saturn is a morning star in Sagittarius, and rises between 3 and 4 in the morning.

Uranus is in Pisces and sets near 9 P.M.; while Neptune is in Leo and comes to opposition on the 19th. At this time he is in 10h 9m 16s R. A. and 12° 2′ north declination; which places him 1° 8′ east and 16′ south of the bright star Regulus. This should make it easy to find him with a strong telescope, but a good star map is an almost indispensable aid unless one makes a sketch map of the faint stars lying to the east of Regulus. Once this has been done the planet should easily be picked up by his motion, which is 6s.4 west and 36″ northward per day.

The moon is in her last quarter at 9 A.M. on February 1st; new at 1 P.M. on the 9th; in her first quarter at 7 P.M. on the 16th, and full at 2 P.M. on the 23rd. She is nearest the earth on the 20th and farthest away on the 4th. As she sweeps around the skies she passes by Saturn on the 5th, Mercury on the 8th, Uranus on the 12th, Venus on the 13th, Jupiter on the 15th, Mars on the 18th and Neptune on the 23rd; but none of these conjunctions is apparently close.

Current Bulletin Briefs

(*Continued from page* 172)

HEAT RESISTING ALLOYS is a 28-page bulletin containing valuable information concerning the selection, design, and use of metal castings for high temperature service. *Southern Manganese Steel Company, 6600 Ridge Avenue, St. Louis, Missouri.—Gratis.*

Radio

RECEIVING SETS FOR AIRCRAFT BEACON AND TELEPHONY, BUREAU OF STANDARDS RESEARCH PAPER NO. 19, deals with the various types of radio receiving sets required on commercial and military aircraft. *Superintendent of Documents, United States Government Printing Office, Washington, D. C.—15 cents.*

COMMERCIAL AND GOVERNMENT RADIO STATIONS OF THE UNITED STATES. This 176-page publication contains a list of the commercial and government land and ship radio stations, aircraft stations, commercial broadcasting stations, radio beacons operated by the Lighthouse Service, and the abbreviations used in radio transmission. *Superintendent of Documents, United States Government Printing Office, Washington, D. C.—15 cents.*

Miscellaneous

CALENDAR SIMPLIFICATION is a 16-page pamphlet discussing the progress of the

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

The proposed 13-month calendar has 28 days to the month and an additional fixed annual holiday

campaign to revise the calendar. *International Fixed Calendar League, 1910 Wyoming Avenue, N. W., Washington, D. C.—Gratis.*

EMPLOYMENT FOR AMERICANS IN LATIN AMERICA, an 18-page pamphlet, has been published for the purpose of presenting the facts concerning both sides of a subject on which unbiased information is scarce. *George J. Eder, Chief, Latin American Section, Division of Regional Information, Department of Commerce, Washington, D. C.—Gratis.*

X-RAYING THE EARTH by Professor Reginald A. Daly, is a reprint from a recent issue of the *Harvard Alumni Bulletin*. This 6-page paper is a very interesting presentation of the attempt of scientists to determine the true nature of the interior of the earth. The vibrations and tremblings of the earth are used to "X ray" the deep interior, for earth-waves are analogous to the familiar waves of sound and light. *We believe copies of this paper will be furnished gratis. Reginald A. Daly, 23 Hawthorn Street, Cambridge, Mass.*

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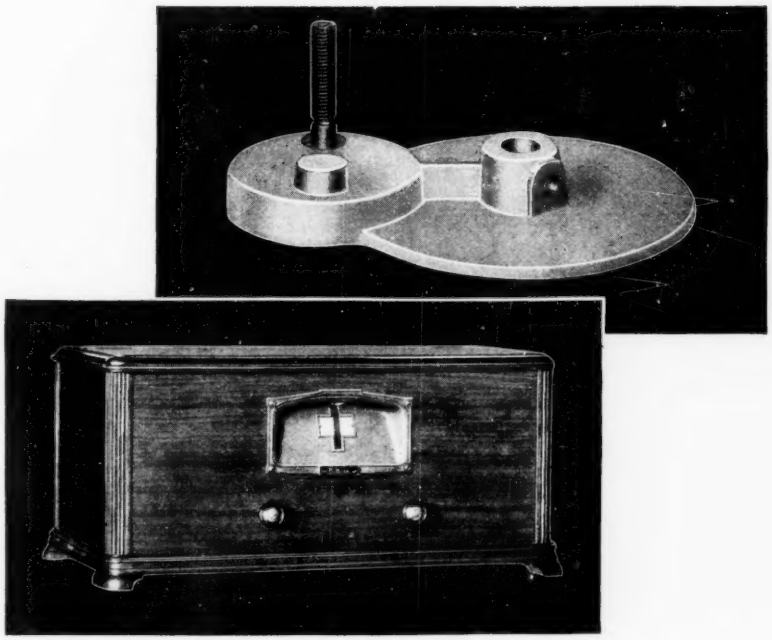
. . By Die Casting . .



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A MILWAUKEE Die Casting containing a cast-in cadmium plated steel insert has replaced a cast iron counter-weight in the new Balkite radio receivers made by Fansteel Products Co., Inc.

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Incidentally, the accurate, uniform weight resulting from die casting in this particular case eliminates the necessity of balancing this part when the receiver is assembled.

Worthy of special mention is the fact that though the steel insert is cadmium plated before the casting is made, the die casting process does not injure the cadmium finish in any way.

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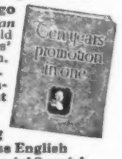

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The Scientific American Digest

(*Continued from page 165*)

Byrd and himself in the two sextants.

For several months prior to his departure, Shropshire, upon whose navigating ability the expedition will depend whenever Commander Byrd is not flying, made a series of observations for altitude with the bubble sextant, from the roof of the Hotel Biltmore in New York City, where the expedition had its headquarters. His efforts were directed to working out the shortest method for obtaining exact location. The fastest method, until recently, required 15 minutes, but Shropshire states that he has succeeded in cutting down the time required for obtaining accurate locations, to less than two minutes—76 seconds, to be exact. Rapidity in obtaining accurate position is made necessary by the speed of the airplanes which will be used. By extreme accuracy is meant within one half to three miles of the actual location. Clear perception of the bubble in the sextant, as the sun is brought into coincidence with it, is essential to such findings, in the Antarctic, where the magnetic influence of the earth is greatly magnified.

Widows Most Settled Type of Store Clerk

WIDOWS who are not too young and not too well educated are the most stable type of saleswomen, according to a survey made by C. J. Ho, at a large New York City department store. Generally speaking, women over 30 years old are less likely to shift from one job to another than younger clerks, he shows in reporting his investigation in *Industrial Psychology Monthly.*

In the three months of the survey, single women left the employment of the store less often than married women, and widows least of all. Clerks whose intelligence was just about average put in a longer term of service with the firm than very dull or very bright saleswomen. The stupid apparently find the work too exactingly difficult, whereas the bright clerk grows bored after a few months of dispensing notions or stockings. Clerks who had the benefit of higher education proved more restless than those who finished their studies in the grammar school.—*Science Service.*

Low Temperature Coffee Percolator

ACCORDING to the Coffee Grower's Association, coffee usually reaches the consumer in a "half-manufactured" state. The completion of the manufacturing process must of necessity take place in the kitchen, and we all know that in a great many cases the beverage is ruined in the making.

With that known fact the coffee trade engaged the Massachusetts Institute of Technology to make a research, and advise as to what was necessary to prevent this trouble. It took about two years, and cost about 125,000 dollars.

The net result of a very lengthy report is that coffee should be brewed, if in metal, in one that is not affected by any organic acid. Secondly, coffee should be brewed at a temperature of 185 to 195 degrees. The common practice is 212 degrees, Fahrenheit, or the boiling point.

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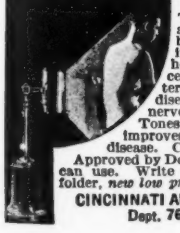

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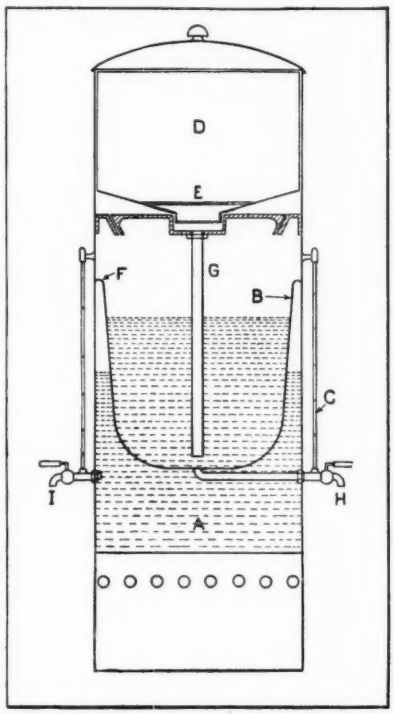
The next step was to produce a foolproof machine that would accomplish this purpose. Therefore a machine was made of pure nickel and Monel metal throughout, with a vitrified china bowl for the coffee container. By means of the apparatus, the brewing takes place at a temperature of 195 degrees, and it is automatic in this respect. The separation of the coffee grounds from the extracted coffee is done by means of a filter



Large size percolator which brews coffee at a low temperature

paper, which is renewed each time, and eliminates the unsanitary cloth bag.

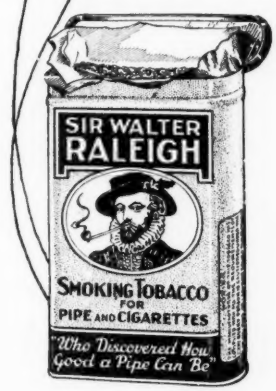
Water is allowed to flow into water jacket "A," also into vitrified china crock "B" from pipe connection in the rear in quantity sufficient to make any predetermined quantity of coffee as indicated on glass coffee gage "C." The correct amount of ground coffee is placed in container on top of filter paper "E."

The water in "A" is now heated and made to boil by means of gas, steam coil, or electric heater. When water in "A" boils, steam rises through port "F" until a slight steam pressure has been created.

The steam, not being able to escape, exerts a downward pressure on the water contained in "B." The water in "B" (which is, in fact, like a double boiler or oatmeal cooker) never boils, but is forced by the steam to rise in pipe "G" through filter "E" in contact with the ground coffee on top of the filter. When this contact is made, the temperature is 195 degrees. A two-minute contact of the water and ground coffee at this temperature makes a perfect decoction of coffee.

The heat is then shut off. Instead of being full of water, "B" is full of live steam. When the heat is shut off, the steam immediately condenses, thus creating a vacuum in "B" which draws the coffee back into "B" through the filter very quickly, leaving the coffee grounds practically dry.

Milder than what?



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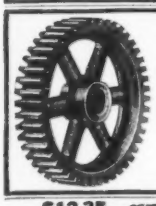

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(*Continued from page* 170)

times the value of the normal loads until the destruction point is reached. By the aid of a transit, deflections at various points along the wing are observed, so that points of weakness are picked out even before the final failure of the structure.

Another exhibit of a scientific character is a gigantic engine test stand. A six cylinder water-cooled engine is mounted on the stand, driving a large two bladed propeller. The engine is supplied with cooling water from a large tank in the back. The whole bed of the engine is pivoted so that the torque of the engine can be weighed. The propeller is surrounded with a circular guard.

One of the most interesting planes seen at Berlin was the Italian hydroplane, *Macchi 52*, which at one time held the world's speed record of 512.776 kilometers per hour (328 miles per hour). The Italian design has some interesting wrinkles for getting speed. The engine is carefully cowled in. The cowling follows even the cylinder heads with smooth curves. A wing radiator is used, as is customary in racers. Owing to the high landing speed, the floats have a sharply pronounced V bottom. The fuselage is filleted into the wing with graceful curves. The tail surfaces blend imperceptibly into the fuselage. The pilot's head almost disappears in the open cockpit, and is protected by a windshield which scarcely interrupts the lines of the body. It is becoming evident that commercial designers will follow racing practice in the near future.

Soviet aviation is said to be progressing very rapidly. Both the construction and the laboratory work of the Soviet engineers are almost on a par with the most advanced aviation countries. At Berlin, the Soviet exhibit of a motor driven sledge attracted particular attention. The sledge is mounted on three skis, with the front one pivoted at the nose of the body, for steering purposes. The three-cylinder air-cooled engine is mounted at the rear of the body and drives a two-bladed propeller which is protected by a guard. The sledge can make over 60 miles an hour, and will undoubtedly prove useful in countries where snow is plentiful, such as Russia or Canada.

Gas Holder as Aviation "Lighthouse"

THE Peoples Gas, Light and Coke Company of Chicago placed in service early in December, a new gas holder (a "tank" to the laity) which is unique in two widely different and superficially unrelated aspects. First, it is a "largest" in the gas industry—being the largest holder ever built anywhere. It holds 20,000,000 cubic feet of gas, and its cost was 1,800,000 dollars. Secondly, it is a "first" in completeness of industrial-structure adaptation to the service of aviation and air navigation.

The new holder is 416 feet high, 283 feet in diameter, and topped with a 70-foot red-light tower.

The body of the holder is painted a sage green. The upper part of it is encircled by alternating 10-foot bands of chrome yellow and black for visibility.

The 70-foot tower surmounting the holder will carry a 1000-watt electric light—red—visible at 15 miles in clear atmosphere. Additional red-lighting is provided by 42 150-watt lamps: a cluster of 14 near

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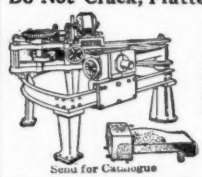

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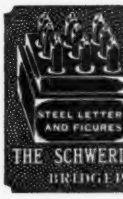

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the top of the tower, a band of 14 around the cornice, and another band of 14 lower down.

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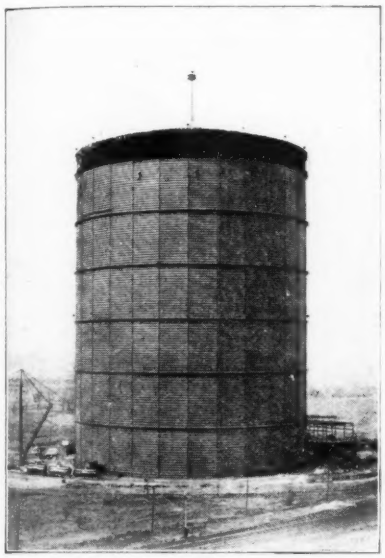

Gas holder as aerial "lighthouse." Note size of freight cars at left

it will be turned on and off automatically, as needed, by an astronomical clock and a photo-electric device controlled by the intensity of light in the surrounding atmosphere.

The gas holder itself is of the modern "waterless" type. Holders of this type, which are rigid structures, are more sightly than the old style of telescopic holder, with its iron girder frame-work.

Some Interesting Books

"AERIAL Photographs," by Dache M. Reeves, published by the Ronald Press, New York, is an authoritative treatise, of interest to officers of every branch of the service who wish to keep informed of the place of aerial photography in scouting, infantry attack, artillery control, and other military operations.

"The World's Wings," by W. Jefferson Davis, has recently been published by Simmons-Boardman, New York. Mr. Davis is an authority on the legal aspects of aviation and was formerly legal adviser to the War Department. His book gives a splendid bird's eye view of aviation in peace and war, in the United States and Europe, interesting to the layman who wishes to get a general perspective of aviation.

"The Zeppelins," by Captain Ernst Lehmann and Howard Mingos, has just been published by J. H. Sears and Company, New York. Captain Lehmann is an experienced constructor and pilot of the great Zeppelin airship factory at Friedrichshafen. Mingos is a skilled and well informed journalist. Between them they have produced an authoritative and vivid history of the development of the airship since its inception.

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Commercial Property News

A Department of Facts and Notes of Interest to Patentees and Owners of Trademark Rights

Are We Slowing Down?

COMMISSIONER of Patents Thomas E. Robertson recently made his annual report to the Secretary of Commerce, showing that applications of all kinds—patents, trademarks, et cetera—received in the fiscal year numbered 116,951, a record number that exceeded the previous high figure of 1927 by 3168. This report is a report of work done; to others is left the task of finding out what, if anything, it signifies.

The significant thing about the figure, to our way of thinking, lies in the **fact** that 1928 was *not* a record year for patents issued. Apparently more inventors are trying to get patents than ever before but a smaller percentage are getting them. These figures comparing applications for inventions with patents issued seem to tell a story:

Year	*Applications*	*Patents*
1924	76,024	39,963
1925	77,926	45,218
1926	80,682	46,464
1927	84,511	43,244
1928	88,482	41,067

Since 1926 the number of patents has been dropping steadily, although the number of applications has been increasing. The population of the country is greater than ever before, the market for inventions of merit is larger, the number of inventors trying is larger. What, then, can be the matter? Are we running out of ideas?

The explanation would seem to lie in the fact that invention is overtaking science. Most patentable inventions are improvements, not basic discoveries. Our inventors have been improving steadily, and the margin of the things remaining to be done within the limits of our knowledge constantly has narrowed.

What we need is more pioneering—someone to push the boundaries of knowledge farther into the unknown—to the end that the great army of lesser inventors can move forward and occupy the new territory with the vast array of minor inventions which add so much to our well-being.

Employers' Shop Rights

THAT an employer may acquire the use of a machine invented by an employee under certain circumstances is generally recognized. As to just how extensive this right is, is a question which sometimes is not so easy to answer. Do, for example, employers' rights cover any machine which may be developed from the first machine, or only for the first machine itself? The case recently brought by the Tin Decorating Company of Baltimore against the Metal Package Corporation and others is a case in point.

The patent in question was obtained by A. W. George for an apparatus for applying hinge pintles to box-part blanks. George was employed by the American Stopper Company in whose plant he had seen the hand process of inserting pintles in tin packages. Believing that an automatic machine might be devised for the work, he constructed in his own home and in his spare time a crude model made of wood whittled out with a penknife. He told A. E. Bruns, formerly employed by the Stopper company that he had a model of the machine. Later Bruns went to the

Inventive genius turned its attention to using waste in the manufacture of paper bags with such success that the only purpose for this incinerator was as a memorial to its erstwhile wasteful usefulness

Metal Package Corporation and became its president. He then hired George, who now gave him the model. The Metal Package Corporation then had a machine made by the E. W. Bliss Company, certain changes being made by employees other than George.

Now George left his new employer and applied for a patent, embodying as his own the changes made by the Metal Package Corporation. He knew the company was using the machine it had made, but he neither made a complaint nor requested payment for its continued use until more than two years had elapsed, at which time he sold his patent rights to the Tin Decorating Company and applied for a reissue.

Meantime the Metal Package Corporation constructed three other machines, each of them costing 35,000 dollars and embodying the changes claimed in the George patent. Such machines are necessary in the conduct of their business. When sued for infringement by the new patent owner, the Metal Package Corporation claimed a shop right or implied license to make and use the patented machines. The plaintiff contended that if there was any license at all, it was confined to the use of the Bliss machine installed during George's employment.

"The authorities are in accord that the scope of an implied license is to be determined by the circumstances out of which it arises, including the relation and conduct of the parties in connection with the business in the development of which the employer's money was expended in making the invention operative, and all the other circumstances upon which agreement may be implied or estoppel enforced," said Judge Thacher in the Southern New York District Court.

"To have limited the license to the use of a single machine rather than to the practice of the invention within the reasonable requirements of the master's business would have placed the trade which both the master and the servant sought to develop at the mercy of the owner of the patent, as soon as the business had grown or the art had advanced to such an extent as to make inadequate or obsolete the original mechanical construction which embodied the invention.

"In a rapidly developing art a license to use a particular machine, as distinguished from a license to use the invention, would often be of no practical importance, and of very little value. With continuous mechanical improvement of machinery so often necessary in modern factory practice a license to use an obsolete machine would be of little value, as the record in this case discloses. It is quite absurd to suppose that the parties themselves would have imposed any such limitation, and none such should be presumed.

"The license to be implied should be co-extensive with the employer's business requirements, because the obvious purpose with which invention and investment were made was to satisfy those requirements, and if the scope of the license was to be less than the breadth of this purpose, it was the duty of the employe to say so. No formal granting of a license was necessary. Silence, under all the circumstances, was sufficient to give effect to a license commensurate with the obvious purpose of the parties."

Trademarks in Greece

ON January 1, this year, there went into effect in Greece a new law under which anyone might register in his own name any trademark not already registered

in Greece. An American manufacturer whose trademark is duly registered in the United States and who has been exporting his branded goods to Greece for years would have no exclusive rights in the matter. For all legal purposes the Greek registrant would be considered the rightful owner.

The paragraph of the law, which was passed last March reads as follows:

"For the use of trademarks already in use, or which have been used but the utilization of which was not interrupted for more than one year, and which either were not registered, or their registration ceased being in force, a term of one year is granted for them to be registered. After the lapse of this period, the depositor, whosever it may be, is considered as the owner of the same trademark."

The period of grace having elapsed, every American manufacturer selling his goods in Greece under a trademark is advised to register that mark in Greece.

Chinese Irish Lace

IRISH lace is lace made in Ireland, a definition which seems unnecessary. It has been necessary, however, for the Federal Trade Commission to make that definition in order to prohibit four New York importing firms from deceiving the public. These firms had been advertising and selling lace made in China, using some word which tended to imply that the lace had been crocheted in the Emerald Isle.

Lace was first crocheted in Ireland in 1847. Irish lace admittedly is superior to the crocheted laces of other countries and brings a higher price. The lace the New York importers were bringing over from China closely resembled the Irish article in pattern and design. The names by which it was called were such as: Irish, Irish Insertion Shanghai, Irish Square Medallion, Irish Shanghai Picot, Irish Swataw Insertion, Irish Picot, Irish Crochet, Irish Edge, Irish Insertion, Irish Shamrock Edge, Irish Crochet Tatting, Shanghai Irish and Chinese Irish Lace.

The order of the Federal Trade Commission prohibits the companies from "selling, advertising or offering for sale in commerce among the several states of the United States lace made in China or elsewhere than in Ireland under a title, name, or designation which includes the word 'Irish' or any other title, name, or designation suggestive of Ireland as the place of manufacture of such lace."

Idem Sonans

RECENTLY the Cadet Knitting Company applied for registration of the trademark "Narroto" for hosiery. The letters were arranged in the form of a flatiron, with the two O's nestled under the cross arm of the T.

Whether the word was registrable or not seemed to hinge on the final letter. If it should be pronounced like the o in *into*, it was harmless; if on the other hand, it should be pronounced like the o in *toe*, it made the word descriptive. Commissioner Robertson was inclined to believe that there is a rule to the effect that when the letters *to* form the final syllable of a word, it has the long sound as in *grotto*, *pluto* or *canto*.

"Obviously," he says, "applicant has adopted a phonetic spelling of the descriptive term *narrow toe* and hence the doctrine of *idem sonans* applies. The doctrine that merely misspelling a descriptive word does not avoid the objection of descriptiveness is well established."

The case is governed, he finds, by the cases involving *Nextobeer*, *Kanelasses*, *Slo Flo*, *Dyanshine* and *Keepclean*, all of which were denied registration because they were descriptive. He concludes:

"Since it is not denied that the words *narrow toe* would be descriptive, I can draw no other conclusion that that 'Narroto' means the same thing and that registration was therefore properly refused."

European Cartels

INTERNATIONAL trade cartels are becoming so numerous in Europe that some American manufacturers have been getting panicky and Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce, has been impelled to issue a lengthy statement on the subject.

A cartel is a trade or industrial combination in some one commodity. Originally they were domestic, their members in each case being all of the same nationality. Now, however, there has appeared the international cartel, grouping the makers of a common product who operate in various countries. These international cartels have as a rule been formed under German leadership, and, with but few exceptions, have no British or American memberships. It is said that those of our industries which would be affected directly by the European cartels have an annual output valued at more than five billion dollars.

"The main object of the typical international cartel is to control competition and thus avert attempts, by the producers of any nation, to indulge in unwarranted price-cutting or to encroach on the logical selling territories of other countries," says Dr. Klein. "Limitation of production—by assigning definite quotas to the different producing countries—is one of its principal functions. Thus—in the Continental view—overproduction is obviated, or controlled within certain relatively harmless channels. Agreements as to division of markets form another aspect of such organizations. Some of the combinations, as I have said, go to the extent of fixing prices, thus achieving an even more direct and effective restraint.

"From the standpoint of the producers, the international cartel has given some promise of more stabilized trade conditions. But as the movement succeeds in this

Patents Recently Issued

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Official copies of any patents listed in this section at 15c each; state patent number to insure receipt of desired patent copy.

Pertaining to Aeronautics

AIRPLANE-WING STRUCTURE—Made up of a plurality of sections, of different strengths to take care of various loads, the parts being connected to form a substantially integral structure. Patent 1693449. Henry J. Le Pul, Oceanside Ave., Hempstead, L. I., N. Y.

PARACHUTE—Having novel means whereby the flow of air through the device may be regulated to retard the descent and conform to the weight of the person descending. Patent 1693518. John H. Kessler, 37 Burd St., Nyack, N. Y.

Pertaining to Apparel

SHOULDER STRAP—Designed to support women's underclothing, and having an elastic portion which will accommodate the movements of the body, without being uncomfortable, or chafing the wearer. Patent 1687592. Anna Rothstein, 4911 N. Bernard St., Chicago, Ill.

Chemical Processes

METHOD OF MOTH-PROOFING FABRICS—Which consists in first treating the fabric with a neutralized aqueous solution of acid casein, wringing it out, and subsequently treating with an aqueous solution of a salt of a rare earth metal. Patent 1688717. Hilton I. Jones, 1538 Forest Ave., Wilmette, Ill.

Designs

DESIGN FOR A DRESS—Patent 76914. Katherine E. Burns, c/o Franklin Simon Co., 38th St., & 5th Ave., New York, N. Y.

DESIGN FOR A DRESS—Patent 77040. Maude Siegel, c/o Franklin Simon & Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR A HAT—Patent 76902. Irwin B. Simon, c/o Simon Millinery Co., 989 Market St., San Francisco, Calif.

DESIGN FOR A DISH OR SIMILAR ARTICLE—Patent 76681. William P. Graham, c/o Graham & Zenger, 104 5th Ave., New York, N.Y.

DESIGN FOR A STOCKING—Patent 76690. Nathaniel Judson, c/o Mock & Judson, 212 5th Ave., New York, N. Y.

DESIGN FOR A COAT — Patent 76663. Katherine E. Burns, c/o Franklin Simon Co., 38th St. & 5th. Ave., New York, N. Y.

DESIGN FOR LACE—The inventor has been granted two patents 76659 and 76660. Ben A. Ball, c/o American Textile Co., Pawtucket, R. I.

DESIGN FOR A CHANDELIER—The inventor has been granted two patents for ornamental designs. 76742 and 76743. Walter J. Fielding, c/o Skinner Hill Co., 114 E. 23rd St., New York, N. Y.

DESIGN FOR A STOCKING—Two patents have been granted to the inventor. 76756 and 76757. Ruby Lefi, c/o Lefi & Co., 303 5th Ave., New York, N. Y.

DESIGN FOR A DRESS—Patent 76824. Mildred C. Schmolze, c/o Franklin Simon Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR A DRESS—Patent 76775. Katherine E. Burns, c/o Franklin Simon Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR A MIRROR OR SIMILAR ARTICLE—Patent 76818. Edwin B. Langsdorf, Spring & Crosby Sts., New York, N. Y.

DESIGN FOR A TEXTILE FABRIC—Patent 76784. Carl Edlich, c/o Max Kaufmann & Co., 45 Leonard St., New York, N. Y.

DESIGN FOR A HALLOWE'EN CANDY—Patent 76776. Willis W. Cassidy, c/o Sweet Candy Co., Salt Lake City, Utah.

aspect, the other two elements in the economic picture clearly become concerned. Unless the producer groups make some attempt at least, to consult and win the friendly support of consumers, it is quite obvious that the consumers may resort to some corresponding protective device.

"In many respects the cartels seem to afford a better solution of certain vexatious trade problems than could be expected from international political pacts, tariff unions and similar devices. But the industrial and commercial world is still a long way from abandoning its belief in individualism and competition. It is interested, of course, in the newer developments of these cartels and in their contributions toward more orderly trading and production, but it is by no means ready as yet to accept them as the harbingers of a new industrial and commercial revolution."

Rights Must Be Asserted

A PATENT gives you the right to prevent others from making, using or selling your invention. It is a right, however, which you must actively assert; if you neglect for too long a time to protect against someone who you know is infringing, you will lose your right to collect damages from that person or to prevent his further infringement.

This fundamental principle of patent law was made clear recently in the unsuccessful suit brought by the Dwight and Lloyd Sintering Company against John E. Greenawalt and the American Ore Reclamation Company. Action was brought on the patent issued March 17, 1908, for a process of producing a "sinter" or porous coagulate, out of finely pulverized metalliferous ores. The process is of great value and has gone into universal use in the metallurgical arts.

Greenawalt had been concerned with draft-roasting furnaces since 1901 and had built several experimental ones. In 1906 he obtained two patents for a down-draft furnace and in 1910 a plant under contract with him operated for four months in Colorado. This was as much an infringement of Dwight's and Lloyd's patent, as was his later practice, but, although Dwight saw a photograph of the plant, no action was taken.

As a matter of fact Dwight was infringing Greenawalt's patents, and Greenawalt was pressing him about it. In 1910 Dwight paid Greenawalt 5000 dollars for a license under Greenawalt's patents. Since then Greenawalt licensed various steel and iron companies and more than 25 plants have installed the apparatus and the practice has been continuous. Not until October, 1923, did Dwight and Lloyd file their bill. Their exclusive licensee, the American Ore Reclamation Company, intervened as a defendant. The United States District Court for Southern New York held that the accounting was barred by laches. On appeal, Judge Learned Hand, in the Circuit Court, said:

"It is not as if Greenawalt were a recent or sporadic interloper in the field: he was in the business, a by no means infertile inventor, an active and driving competitor. We think that Dwight must be charged with knowledge of what Greenawalt had done and proposed to do for certainly 13 years before the suit was filed.

"Meanwhile Greenawalt had built up a very large business, which he estimated to amount in all to about 300,000 tons a year. It is quite true that this has not been by building his own plants; he has exploited his invention only by granting licenses, but the assurance born of such long inaction is for that reason no less. In the case of any accounting, the result of a decree is never more than to take from the infringer money that he has collected in the past, or to charge him with damages. The disuse of his plant follows only upon an injunction, and, as substantially all the decisions turn upon the right to an accounting, they are as relevant when the infringer has not manufactured as when he has.

"Each year as it passes inevitably builds up a belief, if nothing has been done, that the patentee does not suppose his rights invaded, and, if the time be long enough, the infringer garners the harvest of even the earliest of the six years to which recovery is in any event limited, with just confidence that he will not be disturbed. To allow this reasonable inference to be upset, and his financial life perhaps to be gravely deranged, is thought to be incommensurate with the importance of the patentee's stale claims."

DESIGN FOR A CUFF BUTTON OR THE LIKE—The inventor has been granted two ornamental designs. Patents 76891 and 76892. Frederick C. Rile, 6022 Calumet Ave., Chicago, Ill.

DESIGN FOR A DRESS—The inventor has been granted three patents 77035, 77036 and 77037. Mildred C. Schmolze, c/o Franklin Simon & Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR A STATUETTE—Patent 76928. Harrie C. Green, Box 34, Hubbardston, Mass.

DESIGN FOR A COAT—Patent 76981. Elizabeth Carney, c/o Franklin Simon & Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR LACE—The inventor has been granted patents for two ornamental designs, 77003 and 77004. Reginald A. Hollingworth, c/o Am. Textile Co., Pawtucket, R. I.

DESIGN FOR A FIRESIDE GOLF GREEN—Patent 77020. Carl A. Meilicke, 5423 Winthrop Ave., Chicago, Ill.

Electrical Devices

ELECTRIC CONTROL APPARATUS—Whereby sounds of different pitch, such as transmitted by wireless telephony, may be segregated and employed to set in motion through co-operating devices, definite mechanical motions. Patent 1689121. William S. Ferdon, 201 W. 67 St., Kansas City, Mo.

CODE-SENDING APPARATUS—Having a keyboard similar to a typewriter with a separate key for each code character so that a single key depression will transmit the corresponding signal. Patent 1690023. Louis J. Levy, 553 Jersey Ave., Jersey City, N. J.

HEATING DEVICE—An electric heater which is adapted to be secured in place within a storage tank for liquids, for maintaining the water at a predetermined temperature. Patent 1690986. Barnett W. Macy, c/o W. E. Knight, Commercial Clearing Corp., 111 W. Bay St., Jacksonville, Fla.

ELECTRIC CIGAR AND PIPE LIGHTER WITH EXCHANGEABLE INCANDESCENT BODY—The current conducting element being movably located so that contact is established only if the lighter is brought into certain positions, either inclined or upside down. Patent 1691836. Heinz Agatz, c/o Albert Elliot, 246 Friedrick Strasse, Berlin S. W. 48, Germany.

RADIO AERIAL SUPPORT—Including a mast and an adjustable holder which is particularly adapted for attachment to a chimney, for supporting the mast against accidental displacement. Patent 1691864. Carl Wicke, c/o Farmers Loan & Trust Co., 475 5th Ave., New York, N. Y.

INSULATOR-LOCKING DEVICE—For locking insulators used on electric light, power and telephone lines, the device is virtually self-locking when screwed on to the pin, and may be employed with standard pins. Patent 1691964. Ray S. Dickey and Paula Carnahan, c/o P. A. Carnahan, Western Light & Power Co., Salina, Kans.

SWITCH—Which may be installed in an electric iron handle or grip and yieldingly held in closed position by the pressure of the hand, and open when not in use. Patent 1691291. Joseph K. Kahaleohu, 1814 Hampshire St., Quincy, Ill.

CONDUIT BUSHING—Adapted for electrical work, wherein a seal renders the bushing air and water tight, and also serves to lock the bushing so that it will be held under vibration. Patent 1692710. John A. Spahn, c/o Electric Contracting Co., 111 W. 8th St., Wilmington, Del.

Of Interest to Farmers

FROST-PREVENTION APPARATUS—For orchards and vinyards, in which the distribution of the pressure fluid is effected automatically when the temperature surrounding the vegetation approaches freezing point. Patent 1688802 James W. Crowhurst, 4157 Beverley Blvd., Los. Angeles, Calif.

41,000,000 Pounds of Snuff

IN 50 years, the production of snuff in the United States has increased from 4,000,000 pounds a year to 41,000,000, according to a recent report of the Department of Agriculture. Estimating that the snuff user consumes four pounds of snuff a year, the figures indicate that approximately one tenth of the population of the United States are snuff users. These users include people from many walks of life; predominant among them are persons in industries where smoking is prohibited, southern laborers, and immigrants from countries where snuff-taking is a national habit.

Says a report prepared by James V. Morrow, tobacco marketing specialist of the Bureau of Agricultural Economics:

"The American Indians were the original users of snuff in the United States. Tobacco was introduced into Europe about the middle of the 16th Century, and was first used in the form of snuff. Physicians of that day praised its medicinal virtues 'for sneezing, consuming, and spending away grosse and slimie humours from the ventricles of the brains.'

"The use of snuff became so popular that Pope Urban VIII in 1624 issued an edict of excommunication against its use during church services, because snuffing and sneezing interrupted the religious ceremonies. Use of snuff spread to England, Scotland and Ireland, and in the 18th Century snuff taking became the fashion, the lords and ladies taking it in pinches and the scullions and cooks in handfuls.

"The early part of the 19th Century witnessed a decline in snuff taking. Smoking gained in favor, and, of course, predominates up to the present time, but the use of snuff is gradually increasing. From 1880 to 1900 the production of snuff in the United States increased from 3,977,228 pounds to 13,805,311 pounds. By 1905, production reached 23,671,078 pounds, and production has increased steadily since then, the production for 1928 being estimated at 41,451,577 pounds."

It is entirely within the bounds of possibility that in time snuff may supplant cigarettes as our most widespread "bad" habit. Whether it does or not is a matter of comparative profits. Advertising men probably could put it over in time.

WINDSHIELD FOR GRAIN HARVESTER—Designed to protect the cut grain from the action of the wind blowing across the harvester, and permit the grain to fall evenly on the binder. Patent 1690966. George Chaney, c/o Albert R. Redman, Doniphan, Neb.

Of General Interest

MEANS FOR DISPLAYING SAMPLES—Of units such as bricks, so that an architect or builder may assemble in miniature a facsimile of a fireplace, or other architectural assemblage for the approval of a prospective customer. Patent 1688249. Bernard F. Stenz, c/o Simplex Sampling Association, 11th Ave & 25th St., New York, N. Y.

BROOM-HANDLE BRACE—A detachable and adjustable connection for push broom handles, rigidly supporting the handle and relieving the major portion of the strain, in the case of long brooms. Patent 1689109. Richard R. Brock, 806 Quincy St., Brooklyn, N. Y.

WEBBING SUPPORT FOR UPHOLSTERY—Which will resist the tendency of strains on the webbing from pulling out the tacks which secure the webbing to the furniture frame. Patent 1689100. Kegham Balikjian, 26 Homestead Park, Newark, N. J.

HINGE AND COMPACT HOLDER FOR VANITY CASES—Provided with a form of ejector which assists in normally holding the compact in the vanity case while permitting a pull to cause the compacts removal. Patent 1690017. William G. Kendall, 118 Market St., Newark, N. J.

SAFETY DEVICE FOR TRANSPORTING FRAGILE ARTICLES—Such as X-ray, violet-ray, mercury arc vacuum tubes, and large incandescent lamps, whereby means are provided to compensate for vertical shocks and jars incident to travel. Patent 1689588. Walter J. Hoy, 4515 48th St., Woodside, L. I., N. Y.

LIQUID CONTAINER—Which affords facilities for the storage and handling of liquids ordinarily used in cooking, such as oils, and greases, in a convenient and sanitary manner. Patent 1690035. Augustine G. O'Neill and Clarence M. Jones, c/o A. G. O'Neill, Tulsa Tribune, Tulsa, Okla.

FLOAT BALL—For the valve control of flush tanks, formed of glass and having the screw and socket connection of a standard electric bulb type. Patent 1690057. Paul H. Coleman, Box 16, Lynch, Ky.

ICE-CREAM CONE—Having a double wall, with a filling of sweetened cream, or other confection between the walls, which will render the cone more desirable and tasty. Patent 1690984. Fred W. Lane and Kenneth M. Anderson, 4334 Edgewood Ave., Oakland, Calif.

TENSIONING DEVICE FOR CLOTHESLINES—Adapted to be connected with the opposite ends of a line in conjunction with the usual pulleys, for protecting the line against breaking due to wetting and shrinkage. Patent 1690957. Vincent P. Tommins, 60 Glenwood Ave., Jersey City, N. J.

BINDER POST—For loose leaf binders, being longitudinally compressible for compressing a large number of sheets, but after filling is automatically locked against further extension or disassembling. Patent 1690456. Harold T. Payne and Forrest R. Young, P.O. Box 851, Quincy, Cal.

WINDOW VALANCE—A suspended valance having a shaped bottom edge, and strips attached thereto, for uniformly weighting the same, to prevent the lower border curling. Patent 1690298. Frank E. Hood, Janet E. Hood and Alexander G. Morrison, c/o Artcraft Valance Mfg. Co., 1919 2nd Ave., Seattle, Wash.

DRAWING BOARD—Having releasable bolts, whereby a sheet of paper may be readily held in its proper position relative to the edge of the board. Patent 1688516. Charles E. Barker, 1938 Fell St., San Francisco, Calif.

PROCESS FOR MANUFACTURING PLYWOODS—And the removal of defective portions from the upper ply, by cutting out circles and plugging with slightly larger disks securely held in place. Patent 1689705. Fletcher L. Walker, Westwood, Calif.

CONTAINER WITH COVER-LIFTING AUXILIARIES—Having a cap with legs, sufficient space being provided between the legs to permit the fingers to grip the cap for removing it from the supporting surface. Patent 1690479. Charles J. I. Devlin, 224 Stanyan St., San Francisco, Calif.

PLACE INDICATOR FOR TABLES—Especially designed for use on the dining tables of restaurants, hotels and other public eating places, for the ready identification of the various guests. Patent 1692742. Charles F. Jacobs, 279 Park Ave., Brooklyn, N. Y.

DISPLAY STAND—Of cardboard or the like, wherein the parts are so cut that they may be folded and interlocked to make a triangular support for receiving an article. Patent 1692748. Edwin A. Locke, Jr., c/o Nevins Church Press, 250 Park Ave., New York, N. Y.

SNAP FASTENER—Particularly constructed not to tear out of loosely woven fabrics, or other flexible material, formed with male and female members for clamping the fabric. Patent 1692701. Lues Reiter and Allan B. Colby, c/o Rau Fastener Co., 102 Westfield St., Providence, R. I.

DINING CHAIR—Adapted for use in lunch rooms, wherein the right hand corner of the seat is cut away to accommodate the leg of the diner under the food supporting arm. Patent 1693512. Samuel Jaffe, R.R. 2, Box 6, Memphis, Tenn.

WINDOW CONSTRUCTION—Consisting of three sashes, a regular window, a storm sash, and one serving as a screen, all of which may be slid laterally into a recess in the wall. Patent 1693551. Frank X. Graser, John St., Lindenhurst, L. I., N. Y.

Hardware and Tools

FENCE POST—Having a device for fastening wire strands to the post, wherein the strand is received in a slot and held by a V-shaped plug engaging the opening. Patent 1689610. Christian Winter, Oskaloosa, Iowa.

JOINT CONSTRUCTION—For use on cast iron pipe, embodying an elastic ring which is all the more effectively sealed when subjected to the pressure of liquids or gases. Patent 1690047. Fred C. Armbruster, c/o Southwestern Pipe Joint & Engineering Co., 1108 No. 5th St., Birmingham, Ala.

METAL LATH—Which though lighter in construction than the ordinary metal lath, will resist bending and pressure to a greater extent, and will waste less plaster. Patent 1690450. John H. Killion, 1630 Prairie Ave., Chicago, Ill.

NAIL SETTER—Adapted to receive and move nails, one at a time to setting position with one hand, while the other is free to drive the nails with a hammer. Patent 1690987. Edward F. Maloui, 325 "D" St., Marysville, Calif.

WINDOW-SASH HOLDER—Including a strip adapted to be secured vertically on a window frame, and a lateral member adapted to bind against the strip for supporting the sash. Patent 1692731. Anton M. Gunderson, c/o H. J. Rogers, 4929 No. Kailon Ave., Chicago, Ill.

Heating and Lighting

CARBIDE LAMP—A compact lamp of the acetylene gas type, for miners, in which the filtering material is reduced to a minimum, and functioning parts are easily accessible. Patent 1693463. Walter Prockter, Box 1277, Huntington, W. Va.

OIL BURNER—In which the regulation of the flow of air automatically regulates the flow of fuel, thereby forming a perfect mixture with either low or high flame. Patent 1688538. George A. Fiscalini, San Luis Obispo, Calif.

Machines and Mechanical Devices

PUMP VALVE—Having a guide for maintaining the valve properly centered, the valve seat being sheared off at an acute angle to prevent the collection of foreign matter. Patent 1692795. Leslie B. Clifford, 9 Webber Place, Texarkana, Arkansas.

AIR AND GAS CLEANER—For use with air ventilating systems or gas plants, whereby the gas or air is directed through a tortuous path containing a bath for washing the fluid. Patent 1691971. Charles S. Hansard and Archie E. Netzel, Box 364, Avant, Okla.

AUTOMATIC BRAKE OPERATOR FOR INCLINE HOISTS—May be applied to any controller for hoisting engines, but particularly in conjunction with a standard safety device for mine hoists, in raising and lowering cars. Patent 1687621. Henry H. Logan, 6107 Newburg, Norwood Park, Ill.

BEARING BUSHING—Comprising a pair of arc-shaped sections with straight slots in the end, guide keys fitting into the slots, and shims for spacing the sections apart. Patent 1693333. Dwight O. Barrett, R. F. D. No. 4 Springfield, Ohio.

CUTTING DEVICE—Adapted to be associated with a box sealing machine for cutting predetermined lengths of glued paper and automatically sealing the loose edges of a box. Patent 1689110. Walter W. Brust, c/o Sun Lumber Co., Weston, W. Va.

ART OF MAKING MOTION PICTURES—In which only a portion is represented in full natural size, while other parts are at a different scale, but so united as to obtain a natural result. Patent 1690039. Eugene Schufftan, c/o Aktien-Gesellschaft fur Spiegeltechink, Berlin, S.W. 68, Lindenster 32-34, Germany.

CLEANER FOR FILTERING ELEMENTS—Which includes a shaft rotatably and slidably fitted into the filter, whereby the solids are removed and deposited into a sludge chamber. Patent 1689277. Charles St. C. Burns, c/o F. Kay, 435 5th St., Port Arthur, Texas.

NUT-CRACKING MACHINE—Which will effectually crack the shells of the nuts and separate the shells from the meats without affecting or breaking the meats. Patent 1688966. Hiram H. Hill, 1520 Normal St., Chico, Calif.

BABBITTING MACHINE—Which greatly facilitates babbitting operations, and eliminates pits and flaws in rebabbitting the connecting rod and main bearings of automobiles. Patent 1690992. Thomas H. Orr, c/o Orr's Machine Shop, 424 W. 5 St., Okmulgee, Okla.

AUTOMATIC GATE-CONTROLLING DEVICE—Which may be opened by the impact of a vehicle driven against it, the closing movement being checked by the operation of a governor. Patent 1690972. Louise J. Goehrig, Wishek, N. D.

PUMPING RIG—Which is strong, durable and rigid, yet may be readily set up and taken down so that the rig may be used over and over again. Patent 1690955. Gilbert Stouffet, Box 1148, Goose Creek, Texas.

DISPENSING CONTAINER—For dispensing semi-fluids, whereby the slight turn of a lever will cause a plunger within the container to force the fluid from a restricted opening. Patent 1691861. Harry S. Stout, 2 Willow Glen Drive, Huntington, W. Va.

GEAR TEETH—Designed for heavy duty gears, having pinions of low tooth numbers which will have the same tooth pressure and duration of contact as ordinary pinions having many more teeth. Patent 1690931. Sigar D. A. S. Hammar, c/o F. G. Carter, 75 West St., New York, N. Y.

CAMERA—Having the general appearance of an automatic pistol, and operating automatically by actuating a trigger, a plurality of exposures being made in rapid succession. Patent 1690292. Patrick P. Grosso, 1542 East 35th St., Brooklyn, N. Y.

MACHINE FOR DIGGING PIT SILOS AND CISTERNS—Including a tractor, a series of digging disks, means for varying the digging action, and an elevator, all traveling in sequence through a circular path about a common axis. Patent 1691809. Carl H. Huenefeld and George Campbell, Aurora, Neb.

FILTER—Wherein the operation is carried out under pressure without interruption, by virtue of the fact that the separated solids, which tend to retard filtration, are automatically discharged. Patent 1691867. Charles St. C. Burns, c/o F. Kay, 435 5th St., Port Arthur, Texas.

APPARATUS FOR CUTTING CHEESE OR THE LIKE—Comprising a member mounted to swing up and down, and a cutter movably mounted on the member for cutting the upper and underside of the cheese. Patent 1690951. Emil F. Schedwin, c/o Stockholm Patentbyra 7 Vasagatan, Stockholm, Sweden.

TELESCOPIC HOSE COUPLING—For use in connection with gasoline dispensing apparatus, the lower section, carrying the nozzle, telescoping over the upper section, and maintaining substantially a straight line. Patent 1691816. William H. Klyce, c/o Flint Structural Steel Co., Flint, Mich.

GASOLINE STRAINER AND LINT CATCHER—Which is removably mounted on the feed pipe of a tank for straining the gasoline, catching the floating lint, and preventing the clogging of the feed pipe. Patent 1690207. Frank C. Reed, Oregon City, Oregon.

DISH WASHER AND DRYER—Whereby dishes, cups and glassware may be washed, rinsed and dried, and divers other articles may be scoured and burnished with a minimum of labor. Patent 1687458. William H. Lancelot and James A. Starrak, c/oW. H. Lancelot, Room 318, Agricultural Hall, Ames, Iowa.

NUT-CRACKING MACHINE—In which the crusher bar acts with a yielding pressure and permits the cracking of a plurality of different sized nuts without breaking the kernels. Patent 1693493. Eber H. Patton, Longwood, Mississippi.

STITCH AND METHOD OF FORMING THE SAME—Whereby a loose appearing looped formation simulating hand knitting is presented, and whereby a special knit structure may be provided for a part, or all of the garment. Patent 1693439. Albin F. Goetze, c/o Morgan Knitting Mills, 577 So. 10th St., Newark, N. J.

SCREW OR WORM PROPELLER FOR THE PROPULSION OF ALL KINDS OF CRAFT FOR USE IN WATER OR AIR—In which stepped blades are used to reduce the skin friction and enable the blades to turn faster with the same power without reducing the vacuum effect. Patent 1688639. John K. Larson, c/o Studebaker Garage, Vancouver, Wash.

APPARATUS FOR DEHYDRATING TAR—By utilizing a steam jet which atomizes the tar emulsion, carrying off the water and allowing the tar to fall by gravity to the point of accumulation. Patent 1693549. Roger Grilly, c/o Interstate Equipment Co., 25 Church St., New York, N. Y.

DISPENSING CABINET—Particularly adapted to hold in bulk and dispense separately articles of a cylindrical nature such as the sanitary paper straws used in drinking various beverages. Patent 1693458. Benjamin G. Patterson, 1835 W. 14th St., Oklahoma City, Okla.

Medical and Surgical Devices

OBSTETRICAL INSTRUMENT—Embodying a pair of separable handles and a flexible loop, which after being correctly positioned about the infant's head, may be maintained under tension and manipulated with one hand. Patent 1690942. Edwin O'Dell, Central City.

SANITARY SEAT FOR INVALID CHAIRS—In which the central portion of the seat is hinged, swingable into open position, and then may be moved laterally away from the opening. Patent 1691620. Cecelia C. Wilson, 548 31st St., Oakland, Calif.

Prime Movers and Their Accessories

CARBURETOR—Wherein the fuel level may be maintained for eliminating irregular action when the engine is abruptly tilted as the result of travel over rough roads. Patent 1690962. Herbert W. Allen, c/o R. J. Cross, Laboratory Pro. Co., Mason, Mich.

ATTACHMENT FOR SPARK PLUGS—Which can be readily applied to plugs of different sizes and types, the spark gaps being automatically increased or decreased with the temperature changes of the engine. Patent 1689707. David L. Winters, 852 Hyperion Ave., Los Angeles, Calif.

INTERNAL - COMBUSTION ENGINE — Which eliminates the use of the usual poppet valves, having a rotary valve mechanism, and means whereby the valves and operating mechanism are automatically lubricated. Patent 1689689. Chester G. Ross, P. O. Box 383, Glendale, Calif.

INTERNAL-COMBUSTION ENGINE—Which will insure a thorough exhaustion of the products of combustion, and prevent the incoming charge from mixing with the old, thus securing a maximum from the fuel. Patent 1692730. Emil C. Gundelach, 425 Main St., New Rochelle, N. Y.

AIR CLEANER—For use in removing dust, dirt and any other foreign matter from the air to be drawn into the carbureter of an internal combustion engine. Patent 1693479. Harry A. Edgar, Luverne, Minnesota.

Railways and Their Accessories

AUTOMATIC TRAIN CONTROL—Which will permit a train to run backwards, or against current of traffic, without coming into contact with more than one means employed for actuating the control. Patent 1689738. David C. Meara, 1731 8th Ave., Oakland, Calif.

LOCOMOTIVE TENDER—Which may be loaded in the ordinary way and the danger of coal falling from the side eliminated by means of hinged retaining members. Patent 1691381. Frederick Darby, 1413 E. 68th St., Chicago, Ill.

RAIL JOINT—Which will not only firmly couple two rail ends together against lateral displacement, but will prevent depression of the ends as cars pass from one rail to another. Patent 1692254. Charles K. Freer, Cardinal Hotel, Madison, Wis.

Pertaining to Recreation

BOW AND ARROW—A unique construction, in which the bow shaft is rigid and the bow string elastic, and the arrow is propelled through an opening in the shaft. Patent 1689141. Henry B. Keller, 1716 Newkirk St., Philadelphia, Pa.

SWIMMING DEVICE—On which an uninitiated operator may support, propel and steer himself on the water, the device is foldable for storage, and adjustable for the height of the user. Patent 1692753. Christian Meyer, 8510 Grand St., Elmhurst, L. I., N. Y.

GAME APPARATUS—For golf-putting practice, consisting of a plate with pockets arranged at diverse angles, some with passageways constituting hazards, so that the putting must be done with accuracy. Patent 1693474. Frederick L. Burt, 56 Highwood Terrace, Weehawken, N. J.

Pertaining to Vehicles

WARNING SIGNAL FOR PNEUMATIC TIRES—In the form of a colored flap, attached to the outer side of the tire, operable as the air escapes from the tire to attract the driver's attention. Patent 1687761. Waldo F. Hahn, Box 612, Tampa, Fla.

SHOCK ABSORBER—Of the hydraulic type, in which the by-pass has an adjustable fluid regulating member which may be set from the exterior of the casing. Patent 1687620. Henry H. Logan, 6107 Newburg, Norwood Park, Ill.

FOLDING LICENSE PLATE—A theft preventing device, to be easily removed by the owner, a car operated without a license being quickly noticeable by the police as driven by an unauthorized person. Patent 1689140. Herman Jaschun, 124 Ft. George Ave., Apt. 7C, Brooklyn, N. Y.

HAND TRUCK—Wherein a tiltable lifting frame is elevated by foot operated mechanism, after picking up a bale, or other object, for dumping or stacking the same. Patent 1689156. Earl Ruffner, 2411 Buchanan St., Wichita Falls, Texas.

BASSINET—Which is particularly adapted for use in motor-cars, and will comfortably hold an infant cushioned from the shocks and jars incident to normal travel. Patent 1689091. Homer S. Watt, c/o Gordon Motor Crib Co., Port Chester, N. Y.

DUMP BODY—Which may be operated manually from the driver's seat on a wagon, without gears, cylinders or other complicated parts involving the use of power from the vehicle. Patent 1690045. Frank R. Allen and Henry M. Champion, c/o F. R. Allen, Ark. Natural Gas Bldg., Pine Bluff, Ark.

PROCESS OF MAKING RADIATOR CORES—For use on automobiles, whereby tubular members may be provided with two rows of fins mounted in a spiral arrangement without wasting any material. Patent 1689568. Benjamin H. Wade, 2341 Cottage Grove Ave., Chicago, Ill.

GREASE-MEASURING DEVICE—Which is particularly useful for measuring the amount of grease which is dispensed in applying it to automobiles, and may be adjusted to deliver any desired quantity. Patent 1688505. Jacob C. Mulder, 6 Eaton Court, Watsonville, Calif.

TRAFFIC SIGNAL—A combination of electrically and mechanically operated means for signalling to approaching or following traffic that a turn or stop is contemplated by the operator. Patent 1690971. Judson B. Freidah, 1 Silvern Terrace, Washington Heights, New York, N. Y.

TRAILER HOIST AND COUPLER—Which may be readily manipulated by the driver of a tractor for raising and lowering the front end of the trailer, and for connecting and disconnecting the trailer. Patent 17124 (Reissue) William Mayer, 47 Gowne St., Forest Hills, L. I., N. Y.

TRUCK BODY—A multiple deck body, the frame of which is of open work steel made up of T-beams, providing little lodgment for dirt, and easily cleaned. Patent 1691859. Fred Schelben, c/o Greenville Boiler & Machine Works, Greenville, Miss.

PEDAL HOLDER—For use in automobile shops and garages, for the purpose of holding either the clutch or brake pedal in depressed position, so that adjustments may be made. Patent 1691822. Louis W. Lindmeyer, 131 W. Cooper St., Butte, Mont.

VENTILATING DEVICE—For vehicle windows, having a baffle extending downwardly in front of the upper edge, permitting ventilation when the window is slightly lowered, without rain or strong wind blowing in. Patent 1693497. Ralph R. Russell and John S. White, 312 So. 4th St., Paducah, Ky.

VEHICLE SPRING TIRE—Adapted for disposition within a tire casing, eliminating a pneumatic tube, comprising a plurality of cooperative elements, any one of which may be readily replaced. Patent 1692711. Litch J. Swartz, Box 94, Wenatchee, Wash.

RABBIT-CARRYING TRUCK FOR GREYHOUND RACING—Having means for supporting a lure such as an imitation rabbit, which will be more reliable in operation in its movements from luring to non-luring position. Patent 1692736. George W. Heintz, R.F.D. 3, Hamilton, Ohio.

SIGNALING DEVICE—An electric lamp, the cord of which is wound upon a spring-operated drum within convenient reach of the driver who may extend the lamp for signaling. Patent 1691400. Malcolm E. Mitchell, 1209 Park St., Alameda, Calif.

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INDEX TO ADVERTISERS

SCIENTIFIC AMERICAN—FEBRUARY, 1929

American Farm Machine Co.	182
American Lead Pencil Co.	181
American Pipe Bending Machine Co.	182
American Tobacco Co.	171
Atlas Indicator Works	180
Theo. Audel and Co.	182
Francis Bannerman Sons	182
Bartlett-Hayward Co.	177
Bernard and Heller	180
Charles Bond Co.	181
Box 400	180
Brown and Williamson Tobacco Co.	181
Carnegie Institute of Technology	182
Chicago Stock Gear Works	182
Chicago Technical College	183
Cincinnati Automatic Machine Co.	181
Coyne Electrical School	182
Crescent Tool Co.	180
F. J. Drake and Co.	183
Du Maurier Co.	180
Ethyl Gasoline Corp.	97
Gilson Mfg. Co.	183
Hill, London, Eng.	182
International Correspondence Schools	192
International Ticket Scale Corp.	98
Kansas Seed Co.	180
Laboratory Materials Co.	182
Lambert Pharmacal Co.	173
LaSalle Extension University	180
Los Angeles Chamber of Commerce	102
Masonite Corp.	169
Metal Cast Products Co.	182
Metallic Sign Letter Co.	182
Milwaukee Die Casting Co.	179
William Mogey & Sons, Inc.	182
Munn & Co.	180 & 183
W. Ottway & Co., Ltd.	183
Packard Motor Car Co.	Third Cover
Pathfinder Publishing Co.	182
Popular Chemistry Co.	182
Private School of Languages	180
P. O. Box 486, N. Y. C.	180
R. J. Reynolds Tobacco Co.	Fourth Cover
Roat and Lohman	183
Schwerdtle Stamp Co.	182
Science News-Letter	183
Charles A. Scott	180
James Sinclair	180
S K F Industries, Inc.	Second Cover
South American Service Bureau	182
Standard Engine Co.	180
Stephenson Laboratory	182
Timken Roller Bearing Co.	100
Unisol Mfg. Co.	182
Veeder-Root, Inc.	176
Henry Zuhr, Inc.	181

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